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Use of phonological processes in children learning English as a first language and in Hmong children learning English as a second language

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THE USE OF PHONOLOGICAL PROCESSES IN CHILDREN LEARNING ENGLISH AS A FIRST LANGUAGE AND IN HMONG CHILDREN LEARNING ENGLISH AS A SECOND LANGUAGE

by

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The Use of Phonological Processes in Children Learning English as a First Language and in Hmong Children Learning English as a Second Language (113 pages)

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The purpose of this study was to compare the differences in phonological process production between children learning English as a first language and those learning English as a second language. Subjects from each group were matched on the basis of sex, age, and motor skills. The results of this study indicated that the matched pairs of subjects used the same phonological processes the majority of the time. Further, the results indicated that the ability of the subject pairs to use and not use similar phonological processes was more closely related to English language skills than to motor skills.

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

CHAPTER I

INTRODUCTION

Persons who are concerned with children's phonology need to have some knowledge of the phonological theories, as well as knowledge of the acquisition process. At this time, no single theory is widely accepted (Smith, 1981). Each of the theories provides ways to examine and to understand certain aspects of phonology, with certain benefits and limitations. Much of the information regarding the acquisition process has concerned the phonological development of normally developing children acquiring a first language. Recently, investigators have realized that knowledge of phonology may be enhanced by examining the phonological development of children who are not developing language in a normal fashion (Dulay and Burt, 1974; Ingram, 1976). This includes examining the phonological development of children who are acquiring two languages.

Speech clinicians are often asked to assess the speech and language of children who are acquiring a second language, but little information is available to help them distinguish between normal and abnormal patterns of acquisition in such children. Investigations of phonological development in children acquiring a second

language may help to establish normative data as well as to provide a better understanding of phonological development in general.

INTERACTION OF THEORIES AND RESEARCH

Knowledge of phonology has been influenced by data which have been collected, and theories which have been postulated. Both of these are essential to understanding phonological development in children. The normal pattern of sound acquisition in monolingual children has served as the data base for phonological development. Such normative data are limited in that they only describe language behavior, but not explain it (Smith, 1981). Theories on phonological acquisition attempt to explain the language behavior, but should also account for the descriptive data. Theories and empirical data must be examined together in order to enhance our knowledge of phonology in children.

THEORIES ON PHONOLOGICAL DEVELOPMENT

Phonological theories are relevant to this study, however, since this document is not intended to be an in-depth review of current theories in phonology, the discussion will be limited to phonological acquisition as addressed by three predominant theories. Issues of acquisition which are relevant to this study will also be discussed which include the theorists' views of the child as an active or passive learner of phonology, the role of motoric and

linguistic capacities of the child during acquisition, and the underlying representation system of the child as it relates to the adult model.

The first theory discussed concerns the theory of the universal order of acquisition of phonology, introduced by Jakobson in 1941 but not translated into English until 1968. He advocated that the order of sound acquisition is the same for children, whether they learn the same language, or learn different languages. The order of acquisition is similar across children because the motoric capacities of all children are similar. Jakobson proposed that the first sounds learned by children are those with the greatest contrast between them, e.g., the maximally closed /p/ and the maximally opened /a/. Children develop the neurological, anatomical, and physiological structures in the same manner, regardless of the specific language to which the child is exposed. Jakobson viewed the child as an active learner of language who constantly attempts to match his production to the model which he hears. The implication of this viewpoint is that the child has the same underlying representation of sounds that adults have, and differs only in his surface production. The child continuously monitors his own productions, and compares them to the adult model. As the child acquires the necessary motor skills, his productions gradually match the adult model.

The transformational, or generative, theory of phonology was introduced by Chomsky and Halle in 1968. Their theory concerned the linguistic, rather than the motoric capacities of children. They postulated that children are born with an innate capacity to generate an infinite number of sounds and sound patterns. The specific language to which a child is exposed determines which particular sounds a child will acquire. A child develops his own phonological system which operates independently of the adult model, i.e., children and adults differ not only in their surface productions, but also in their underlying representation of language. These differences are attributed to the limited exposure to language by a child. As a child's linguistic capacities develop, the child's speech more closely approximates the adult model. Chomsky and Halle's emphasis on language exposure as the key element in acquisition implies that the child is a passive rather than an active language learner. Chomsky and Halle introduced the aspect of patterns of sounds in children's acquisition of speech, as well as the acquisition of individual sounds.

The third theory presented is Stampe's (1969) theory of natural phonology which was based in part on Chomsky and Halle's theory of transformational phonology. Stampe's theory combined the linguistic and motoric capacities of the child in acquiring phonology. He viewed the child as innately endowed with the capacity for acquiring phonology,

and this acquisition was facilitated by exposure to language. The child is an active learner of the phonology of a language, and readily perceives the differences between the language he produces, and the language that he hears. The child uses these perceptual skills to modify his own phonological system. According to Stampe, a child's surface production differs from the adult model due to phonological processes in a child's speech. These processes are present from birth, and are used by children to systematically simplify the sound system during the language acquisition period. They simplify a child's productions of sounds by allowing the deletion of certain elements, minimizing certain phonological contrasts, and specifying the use of less physically difficult sounds for more physically difficult sounds (Oller and Warren, 1976). Phonological development involves a child's active suppression of phonological processes over time which make his speech different from an adult model. For example, once a child perceives that his speech differs from an adult form by a phonological process of Cluster Reduction, a child attempts to suppress that process in order for his production to more closely match the adult's.

The theories described above emphasize the role of motoric or linguistic capacities in a child's speech production. These roles could be more closely examined by studying the speech of children whose motoric capacities are

similar, but whose linguistic capacities are dissimilar. Children of the same age who are learning English as a first language and as a second language would have similar motoric capacities, but would differ in regards to their linguistic experience. Comparing these children on an aspect of language such as phonological processes may help identify the influence of motoric or linguistic capacities on speech production.

RESEARCH IN PHONOLOGICAL DEVELOPMENT

Phonological theory has influenced the manner in which acquisition of sounds in children has been studied. Early empirical research investigated the production of single sounds (Wellman, Case, Mengert, and Bradburg, 1931; Poole, 1934; Templin, 1957). This research usually involved cross-sectional studies of large numbers of children learning their first language. Other researchers investigated universal aspects of phonology by studying the similarities of phonological development across languages (Menyuk, 1968; Pertz and Bever, 1975). These studies usually consisted of a smaller number of children learning their first language. Studies have been done on the production of sound patterns in normally developing and language disordered children learning English as a first language (Ingram, 1974; Oller and Warren, 1976; Shriberg and Kwiatkowski, 1980; Smith, 1981). However, a review of the

literature revealed only one study which investigated phonology in children learning English as a second language (Hecht and Mulford, 1982). No studies were found which compared the phonological development of children learning English as a first language to that of children learning English as a second language.

CONTRIBUTION OF SECOND LANGUAGE STUDIES

The majority of research in phonological development has primarily investigated the language acquisition of monolingual children. Information on the phonological development of children learning two languages may contribute to the understanding of phonological development in general. Much of what is known about the language of bilingual children concerns syntactic development (Dulay and Burt, 1974; Volterra and Taeschner, 1978). At this time, information on the phonological development of children learning a second language is limited. The role of linguistic versus motoric capacities in phonological development could be examined in studies involving children learning a second language. If the linguistic capacities of children determine their production of sounds (Chomsky and Halle, 1968), then the phonological development of children learning a second language would differ significantly from first language learners because of the difference in language exposure. If the motoric capacities of children determine

sound production (Jakobson, 1968; Stampe, 1969), the phonological development of children learning a second language should be similar to children learning a first language, if age and motor development are similar. The influence of linguistic and motor capacities on speech would have direct implications on speech and language intervention. For example, if the linguistic experience of a child plays a major role in the production of speech, remediation would need to emphasize linguistic factors. If the motoric capacities of a child were found to heavily influence speech, then remediation would need to direct its emphasis toward improvement of motor skills in speech. A study which involves a homogenous group of subjects learning English as a second language, i.e., a group of children with the same native language would allow for the identification of pertinent variables but the procedure may limit the later generalities of the study.

RESEARCH QUESTION

The research question in the present study is: Are there significant differences between children learning a first language and children learning a second language in their use of phonological processes? In addition, if differences exist between the two groups of children, the extent to which the phonological processes are distributed

within the groups will be examined. Finally, the patterns of phonological process usage will be described.

CHAPTER II

METHODS

OPERATIONAL DEFINITION

For the purpose of the present study, a phonological process was defined as a systematic simplification of speech productions which occurred in two or more segment classes. Certain criteria need to be established for the presence of phonological processes in the assessment in children's speech (Ingram, 1981; McReynolds and Elbert, 1981). In the present study, one criterion involved the consistency of occurrence for the processes. McReynolds and Elbert (1981) set their frequency criterion at 20 percent, which they describe as "lenient." For the purposes of this study, a criterion of 40 percent frequency was used. In The Assessment of Phonological Processes, Hodson (1980) recommended a 40 percent criterion of frequency to separate significant from non-significant occurrences. This criterion minimized the possibility of labeling "chance" productions as phonological processes. It applied to the occurrence of a process in any of the three word positions (initial, medial, or final) or in any one word position.

Another criterion involved the selection of the processes to be investigated. The processes which were used in the present study were taken from The Assessment of Phonological Processes (Hodson, 1980). These processes are similar to those in other studies (Oller and Warren, 1975, Ingram, 1976; Weiner 1979; Shriberg and Kwiatkowski, 1980). Appendix A contains a listing of processes used by these investigators. In addition to being used by other researchers, these processes are generally considered ones which occur frequently in the speech of children acquiring English. The specific processes studied are as follows:

1. Syllable Reduction (SR)
2. Cluster Reduction (CR)
3. Obstruent Singleton Omission (OSO)
4. Stridency Deletion (STD)
5. Velar Deviation (VD)
6. Prevocalic Voicing (PV)
7. Postvocalic Devoicing (PD)
8. Glottal Replacement (GR)
9. Stopping (S)
10. Backing (B)
11. Affrication (AF)
12. Deaffrication (DA)
13. Palatalization (P)
14. Depalatalization (DP)
15. Coalescence (C)
16. Epenthesis (E)
17. Metathesis (M)
18. Sonorant Deviations (SD)
19. Assimilation (AS)
20. Articulatory Shifts (ATS)

These processes are defined in Appendix B.

SUBJECTS

Two groups of subjects participated in the present study. One group of children was learning English as a

first and only language and is referred to in this study as the EFL group. Another group of children came from homes where Hmong, a Sino-Tibetan language, was the dominant language. These children were acquiring English as a second language and are referred to as the ESL group in this study. For inclusion into the study, all subjects met the following criteria:

1. Chronological age between 4.0 and 5.0 years. This age was selected since some phonological processes are normally prevalent in children's speech (Ingram, 1981). The age of children was verified by their parents.

2. Each child was without physical or neurological problems. This was also verified by parent report.

3. Hearing was within normal limits. Each child's hearing was screened using an audiometer (Beltone, model 10 D) at 20-dB HL (re: ANSI, 1969) at 1 and 2 kHz, and 25-dB HL at 4 kHz.

4. Motor development was within normal limits. This was assessed using the five motor subtests from the McCarthy Scales of Children's Abilities (McCarthy, 1972). A description of the tasks involved in the motor subtests is listed in Appendix C.

In addition to the above entry criteria, the EFL subjects were required to demonstrate age appropriate speech and language development. Age appropriate development was demonstrated in two ways. First, each child performed

within one standard deviation of the mean for his/her chronological age on the Templin-Darley Screening Test of Articulation (Templin and Darley, 1960) or on single consonants on the Templin-Darley Test of Articulation. In addition, each child scored within the 25-75th percentile range on the receptive portion of the Northwestern Syntax Screening Test (Lee, 1971).

The ESL subjects demonstrated a minimal level of English language proficiency in order to participate in the study. Each child in the ESL group scored at least at the 2;6 year level in auditory comprehension and verbal ability on the Preschool Language Scale (Zimmerman, Steiner, and Evatt, 1969).

MATCHING CRITERIA

The first subjects were selected to form the ESL group. An EFL child was then selected and matched to an ESL subject on the basis of sex, chronological age and performance on motor subtests. The chronological ages of the matched subjects were within three months of each other. Their performance on the motor skills subtests was within plus or minus the standard error of measurement of the raw scores on the McCarthy Scales of Children's Abilities (McCarthy, 1972).

STIMULI

To ensure that the selected phonological processes had opportunities to occur in different segment classes, in a variety of word positions, and in the same frequency for all subjects, The Assessment of Phonological Processes (Hodson, 1980) was used. This instrument was selected because the elicitation items were assumed to be objects with which the children in both groups would be familiar.

PROCEDURE

The subjects were seen individually for a period of approximately two hours each by a second year graduate student clinician in Communication Sciences and Disorders. This clinician was not familiar with the Hmong language or the Hmong culture. All procedures were administered in a separate room adjacent to the day care center. The ESL subjects were selected initially and the information regarding entry criteria was obtained in the following manner:

1. Age
2. Physical or neurological problems
3. Language proficiency
4. Hearing
5. Motor development

The EFL subjects were selected and information was obtained in the following order:

1. Age
2. Physical or neurological problems
3. Hearing
4. Articulation
5. Language development
6. Motor development

If the subject successfully met the requirements for the entry criteria, The Assessment of Phonological Processes (Hodson, 1980) was then administered. Following completion of this test, a language sample of approximately one hundred utterances was obtained from each subject. Stimulus materials for the language samples were selected to appeal to the interest of each specific subject. The subjects' responses obtained on The Assessment of Phonological Processes (Hodson, 1980) were transcribed on-line using broad transcription techniques. The transcriptions obtained were perceptually based by an English speaker not familiar with the Hmong language. The test was recorded on a reel-to-reel tape recorder (Uher, model 4000) and the language sample was recorded on a cassette tape recorder (Sony, model TCM 747) using audio cassette tapes (Fuji, FX-1).

MEASUREMENTS

The measurements obtained were the frequency of occurrence for each phonological process. Occurrence for any given process could be achieved in a variety of ways. For

example, the process Cluster Reduction was considered present if a subject made substitutions for or omitted either or both of the consonants, regardless of whether the cluster occurred in the word initial or the word final position. Similarly, the process Sonorant Deviation was considered present if a subject substituted or omitted any of the sonorants within a word. A process was considered to be present if it was demonstrated 40 percent or more, and was considered absent if it was demonstrated less than 40 percent.

DESIGN AND ANALYSIS

The research design was a two by twenty split plot with repeated measures on the last factor. The presence of each phonological process was viewed independently of the presence or absence on any other phonological process on other opportunities.

To stabilize variance and minimize "floor" and "ceiling" effects, all scores were arc-sine transformed prior to data analysis. To provide additional information on an individual's performance on any given phonological process, the probability that the performance would occur by chance was determined. Specifically, since each opportunity (trial) for each phonological process could be scored present or absent, and each trial was independent of the other trials, the performance scores for the phonological

processes could be viewed as the sum of Bernoulli processes which conform to a binomial distribution.

RELIABILITY

As noted previously, each administration of The Assessment of Phonological Processes (Hodson, 1980) and language sample was recorded on audio tapes. These tapes were used for obtaining intra- and inter-observer reliability measures.

The Assessment of Phonological Processes was scored on-line and two tests from each group were re-scored by the examiner for a measure of intra-observer reliability. For inter-observer reliability measures, two audio tapes from each group were analyzed by an independent observer who was familiar with the procedure. In order to provide a reference for reliability interpretation, the probability of chance was also determined using a formula provided by (McReynolds and Kearns, 1983). Intra- and inter-observer reliability measures, along with the probability of chance for each measure, are presented below.

	Inter-observer	Chance
EFL Group	94.8	84.6
	92.4	90
ESL Group	90.6	69.5
	87.5	70.4

	Intra-observer	Chance
	94.4	90
EFL Group	94.8	94.5
	89.7	74
ESL Group	90.1	74.6

All reliability coefficients were above those obtained by chance.

CHAPTER III

RESULTS

DATA ANALYSIS

Two analyses were used to reduce the data obtained from the subjects' performance on The Assessment of Phonological Processes (Hodson, 1980). The specific data for each subject are contained in Appendix D. The first analysis employed a pre-determined criterion production level of 40 percent or greater, relative to the total possible occurrences for any given process in order to establish the presence of a process. The second analysis employed a binomial distribution model which enabled each process to be compared to the production of remaining processes for each subject. The results of these analyses are presented in the following sections. The descriptive data for each subject consist of sex, age at the time of testing, raw scores on the motor subtests of the McCarthy Scales of Children's Abilities (McCarthy, 1972), and mean length of utterance (MLU).

PRE-DETERMINED CRITERIA

This analysis was based on a criterion production level of 40 percent or greater, relative to the total

possible occurrences for any given process. This criterion level was recommended by Hodson in The Assessment of Phonological Processes (1980), the instrument employed in this study. The total number of possible occurrences for each phonological process was determined and each subject's use of a given process was converted to a percentage score based on the total possible occurrences for that process. Table 1 contains the results for each group, using the criterion of 40 percent or greater.

An Analysis of Variance (ANOVA) was originally planned to examine the differences between the EFL and the ESL groups in their respective production of phonological processes at the criterion level of 40 percent or greater. However, the data revealed that only a limited number of subjects (one in the EFL group and four in the ESL group) used processes at the pre-determined level. Therefore, a descriptive assessment of the data was considered to be more appropriate than an ANOVA. In the discussion which follows, the processes are followed by numbers which refer to the percent scores for frequency of occurrence for that process.

The EFL group contained one subject who used two processes which met the criterion for this analysis. Subject 5-EFL used Deaffrication 57%. In contrast, the ESL group contained four subjects who used processes which met the pre-determined criterion level. Subject 5-ESL used Cluster Reduction 68% and Sonorant Deviation 61%. Subject

Table 1

This table shows the subjects whose phonological process usage was at or above the 40% criterion level. The percentages refer to the number of times the process was produced based on the total number of possible opportunities. (Refer to page 11 for explanation of abbreviations.)

		SR	CR	OSO	STD	VD	PV	RD	S	AF	DA	P	DP	E	M	SD	AS	ATS	B	C	GR
	1																				
	2																				
	3																				
EFL	4																				
GROUP	5										75%		57%								
	6																				
	7																				
	8																				
	9																				
	1																				
	2																				
	3																				
ESL	4																				
GROUP	5		68%													61%					
	6										100%		57%								
	7		54%			54%										88%					
	8					41%															
	9																				

6-ESL used Deaffrication 100% and Depalatalization 57%. Subject 7-ESL used three processes; Cluster Reduction 54%, Velar Deviation 54%, and Sonorant Deviation 88%. Subject 8-ESL used one process; Velar Deviation 41%.

The four ESL subjects demonstrated five different processes. Three of these processes were each used by two subjects; Cluster Reduction, Velar Deviation, and Sonorant Deviation, while the other two processes were used only by one subject. However, the use of three processes from the 20 processes analyzed in this study was not considered indicative of typical performance of the ESL group in general.

In summary, one subject from the EFL group demonstrated processes at the criterion level, and four subjects from the ESL group demonstrated processes at the criterion level. Two of the processes, Deaffrication and Depalatalization were demonstrated by one subject in each group.

BINOMIAL DISTRIBUTION

In this analysis, each process was examined by comparing production of any given process to the production of the remaining processes for each subject. The total number of possible occurrences for each of the twenty phonological processes used in this study was determined. Each subject's use of a process was converted to a percentage score based on the total possible occurrences for

that process. In order to stabilize the variance associated with the percentage of occurrence of the processes, all percentage scores were arc-sine transformed. The binomial distribution model was then used to compare scores with varying frequencies of occurrence and to calculate frequency of occurrence by chance alone for each process (Thorton and Raffin, 1978). In this manner, all twenty processes were compared, two at a time, for each subject. A process was considered to be used at a significant level when the probability of its production, when compared with the production of another process was determined to occur by chance at .05 or less, the level of confidence used in this study. In other words, a binomial distribution model was used to calculate the probability levels that two processes would occur. When chance probability was determined to be .05 or less, the process which had occurred more frequently was considered to have been produced significantly. Tables showing these probabilities for the phonological processes in this study for each subject are located in Appendix E.

Tables 2 and 3 contain the phonological processes which were found to be used by each subject in the EFL and the ESL group, respectively. The tables also list the total number of subjects in each group who demonstrated a given process, as well as the total number of processes which were used by the individual subjects.

Table 2

This table lists the processes used by each subject in the EFL group when a binomial distribution was used. The total number of processes used by each subject is contained in the last row. The total number of subjects who demonstrated a given process is contained in the last column. (Refer to page 11 for explanation of abbreviations.)

EFL SUBJECTS	1	2	3	4	5	6	7	8	9	# of subjects demonstrating process
	SD	SD	SD	SD	SD	SD	SD	SD	SD	9
	PV	PV	PV	PV	PV	PV	PV	PV	PV	9
	CR	CR	CR	CR	CR	CR	CR	CR		8
	DP				DP				DP	3
	DA				DA					2
								SR	SR	2
									PD	1
Total # of processes used by each subject	5	3	3	3	5	3	3	4	5	

Table 3

This table lists the processes used by each subject in the ESL group when a binomial distribution was used. The total number of processes used by each subject is contained in the last row. The total number of subjects who demonstrated a given process is contained in the last column. (Refer to page 11 for explanation of abbreviations.)

ESL SUBJECTS	1	2	3	4	5	6	7	8	9	# of subjects demonstrating process
	CR	CR	CR	CR	CR	CR	CR	CR	CR	9
	SD	SD	SD	SD	SD	SD	SD	SD	SD	9
	PV	PV	PV	PV	PV	PV	PV	PV	PV	9
	DP	DP		DP	DP	DP	DP	DP	DP	8
	SR	SR	SR	SR	SR	SR		SR	SR	8
	PD		PD		PD	PD	PD	PD		6
		SD			SD	SD	SD	SD		5
					OSO	OSO	OSO	OSO	OSO	5
	S	S			S	S		S		5
			VD		VD		VD	VD		4
		DA			DA	DA	DA			4
			ATS	ATS			ATS			3
	M				M					2
							E	E		2
						AS				1
								P		1
Total # of processes used by each subject	8	8	7	6	12	11	11	12	6	

EFL GROUP

Table 2 indicated that the three most frequently occurring processes for the EFL group were Prevocalic Voicing, Sonorant Deviation, and Cluster Reduction. Prevocalic Voicing and Sonorant Deviation were each used by all nine subjects, while Cluster Reduction was used by 8 of the subjects. Four other processes were used by three or fewer subjects; Depalatalization, Deaffrication, Syllable Reduction, and Postvocalic Devoicing. Thirteen processes were not used by any subject in this group; Obstruent Singleton Omission, Stridency Deletion, Velar Deviation, Stopping, Affrication, Palatalization, Epenthesis, Metathesis, Assimilation, Articulation Shifts, Backing, Coalescence, and Glottal Replacement.

ESL GROUP

Table 3 indicated that three processes were each used frequently by all nine subjects in the ESL group; Cluster Reduction, Sonorant Deviation, and Prevocalic Voicing. Depalatalization and Syllable Reduction were each demonstrated by eight subjects. Postvocalic Devoicing was used by six subjects, while Stridency Deletion, Obstruent Singleton Omission, and Stopping were each used by five subjects in this group. Seven other processes were used by fewer than half the ESL subjects; Velar Deviation, Deaffrication, Articulation Shifts, Metathesis, Epenthesis, Assimilation,

and Palatalization. The processes of Affrication, Backing, Coalescence, and Glottal Replacement were not used by any subject in this group.

BETWEEN GROUPS

The three most frequently occurring processes were the same for both the EFL and the ESL groups. Sonorant Deviation and Prevocalic Voicing were each demonstrated by all nine subjects in each group. Cluster Reduction was used by all nine ESL subjects, and by eight of the nine EFL subjects. These three processes were the only ones demonstrated by a majority of subjects in both groups. The groups were also similar in their non-use of certain processes. The processes of Backing, Coalescence, Glottal Replacement, and Affrication were not used by any subject in either group.

The two groups were less similar in their number of processes used. The EFL group demonstrated seven processes altogether, in contrast to the sixteen processes demonstrated by the ESL group. In addition, the EFL subjects, as a group, were very consistent in their use and non-use of the various processes. Three processes were demonstrated by at least eight of the nine EFL subjects; Prevocalic Voicing (9), Sonorant Deviation (9), and Cluster Reduction (8). Four other processes were used by three or fewer EFL subjects; Depalatalization (3), Deaffrication (2), Syllable

Reduction (2), and Postvocalic Devoicing (1). While the ESL subjects demonstrated a certain degree of consistency in their use and non-use of processes, in general, they demonstrated a much wider range of production than did the EFL subjects. Nine processes were demonstrated by five or more ESL subjects; Cluster Reduction (9), Sonorant Deviation (9), Prevocalic Voicing (9), Depalatalization (8), Syllable Reduction (8), Postvocalic Devoicing (6), Stridency Deletion (5), Obstruent Singleton Omission (5), and Stopping (5). However, seven more processes were used by less than half the subjects; Velar Deviation (4), Deaffrication (4), Articulation Shifts (3), Metathesis (2), Epenthesis (2), Assimilation (2), and Palatalization (1).

In summary, the three most frequently occurring processes were the same for both the EFL and the ESL groups; Sonorant Deviation, Prevocalic Voicing, and Cluster Reduction. Four processes which did not occur in either group were Backing, Coalescence, Glottal Replacement, and Affrication. The EFL subjects demonstrated a total of seven processes and the ESL subjects demonstrated a total of sixteen processes. The EFL subjects were relatively consistent in the overall production of phonological processes, while the ESL subjects demonstrated a wider range of phonological process production.

DESCRIPTIVE INFORMATION

As part of the entry criteria into this study, the five motor subtests of the McCarthy Scales of Children's Abilities (McCarthy, 1972) were administered to each subject, which resulted in an assessment of motor ability for each subject. In addition, a mean length of utterance (MLU) was obtained on each subject, which provided an approximation of expressive language skills for each subject. This information, along with the sex and age at the time of testing for each subject is contained in Table 4. Subjects with the same number are considered a matched pair. These data, and how they related to the production of phonological processes in the two groups of subjects are presented next.

EFL GROUP

Raw motor scores on the McCarthy Scales of Children's Abilities (McCarthy, 1972) for the EFL subjects ranged from 24-44 which was considered to represent varying motor skills. The MLUs of the EFL group ranged from 3.8 to 6.2. A study by Miller (1981) indicated that MLUs above 4.49 are not a valid indication of a child's expressive language skills and should be viewed with caution. In the present study, six of the EFL subjects had MLUs above that level. Further, two of the EFL subjects, 4 and 9, had MLUs more than one standard deviation below the mean for children of

Table 4

Subject information on 18 children including sex, chronological age, raw scores on the motor subtests of the McCarthy Scales of Children's Abilities (McCarthy, 1972), and MLU. Ranges for motor scores and MLU for each group are contained in parentheses at the bottom of respective columns.

EFL SUBJECTS

	Sex	Chronological Age Year; Month	Raw Score	MLU
1	male	4;6	44	5.46
2	female	4;11	38	6.2
3	male	4;3	30	4.18
4	female	4;6	37	4.32
5	male	4;1	25	5.84
6	female	4;5	24	4.8
7	female	4;5	24	5.7
8	male	4;2	29	5.18
9	male	4;8	26	3.8
			RANGE (24-44)	(3.8-6.2)

ESL SUBJECTS

	Sex	Chronological Age Year; Month	Raw Score	MLU
1	male	4;7	49	4.5
2	female	5;0	37	4.5
3	male	4;2	35	2.66
4	female	4;8	40	3.99
5	male	4;0	21	2.1
6	female	4;6	21	1.85
7	female	4;2	24	1.4
8	male	4;3	31	1.27
9	male	4;7	30	4.96
			RANGE (21-49)	(1.27-4.96)

their age (Miller, 1981). The EFL subjects had scored between the 25-75th percentile on the receptive portion of the Northwestern Syntax Screening Test (Lee, 1971) as part of the entry requirement into this study which indicated normally developing receptive language in these subjects. While the MLUs of these subjects varied, the receptive language skills of the group were considered to be within the range of normal.

In phonological process production, these subjects revealed a high degree of consistency, with only minor inconsistencies noted. The small amount of inconsistency which was noted was largely due to the production of EFL subjects 1, 5, 8, and 9 who demonstrated processes which were not used by the others. The descriptive information indicated that these four subjects are all male, but another male subject did not demonstrate processes which had not been used by the majority of the group. The MLUs of these subjects ranged from lowest to second highest of the group. Other subjects who also demonstrated low MLUs did not use processes which were not used by the other subjects in the EFL group. The motor scores of the four subjects also ranged from lowest to highest of the group. Therefore, the descriptive data did not reveal any consistent patterns in language or motor skills which would account for any patterns in phonological process production among subjects in the EFL group.

ESL GROUP

The raw motor scores on the McCarthy Scales of Children's Abilities (McCarthy, 1972) for the ESL subjects ranged from 21-49, which was considered to represent varying motor skills. The subjects' MLUs ranged from 1.27 to 4.96 which indicated that the English language skills of the ESL subjects also varied. Three subjects in this group had MLUs above 4.49, the level which Miller (1981) said should be viewed cautiously. The data revealed the ESL subjects were not as consistent as the EFL group in the use of phonological processes, and in addition, subjects 5, 6, 7, and 8 of the ESL group used more phonological processes than the other subjects in this group. The descriptive information did not reveal any indication that phonological process production in this group was influenced by age or sex of the subjects. Two of the subjects who used more phonological processes than the others were female and two were male. They were neither the youngest nor the oldest in this group. However, the descriptive data revealed differences in both motor and language skills in those four subjects who used more phonological processes than did the other subjects in this group. The motor scores of the four subjects were among the lowest in the group. Three of these subjects had the lowest scores of the group on the McCarthy Scales of Children's Abilities (McCarthy, 1972), and the fourth subject had the fifth lowest score in the group. These four

subjects also had the lowest MLUs of the group, ranging from 1.27 to 2.1. These MLUs indicated that these four subjects had the lowest level of expressive English language development of the group. Therefore, the results of this study indicate that both motor and language differences exist between the ESL subjects who used more phonological processes and those remaining ESL subjects who used fewer processes.

MATCHED SUBJECTS

In order to determine whether children of similar motor skills but different language skills used the same phonological processes, the two groups of subjects were matched on age (plus or minus three months), sex, and raw scores (plus or minus 5 points) on the motor subtests on the McCarthy Scales of Children's Abilities (McCarthy, 1972). Table 5 contains information on the use of various processes by the matched subjects in each group. The table contains the number of processes used by both of the matched subjects, and the number of processes used by neither of the matched subjects. These two numbers together determine the total number of identical processes either used or not used by the matched subjects. The table also lists the number of processes which were used by one of the matched pair and not the other, which indicated different use of processes between the pairs of subjects. To aid in the interpretation

Table 5

The columns in this table list the number of processes used by both members of a matched pair of subjects, the number of processes used by neither member, the total of these two numbers, indicating agreement within each pair, and the number of processes used by one member of the pair and not the other, indicating disagreement within each pair. Each number was transformed to a percentage score which is listed at the right of its corresponding column.

Subject Pairs	Number of Processes Used by Pair	%	Number of Processes Not Used by Pair	%	Total Number of Processes Used and Not Used by Pair	%	Number of Processes used By only one Member of Pair	%
1	4	20%	11	55%	15	75%	5	25%
2	3	15%	12	60%	15	75%	5	25%
3	3	15%	13	65%	16	80%	4	20%
4	3	15%	14	70%	17	85%	3	15%
5	5	25%	8	40%	13	65%	7	35%
6	3	15%	9	45%	12	60%	8	40%
7	3	15%	8	40%	11	55%	9	45%
8	4	20%	8	40%	12	60%	8	40%
9	4	20%	13	65%	17	85%	3	15%

of these numbers, percentages of agreement and disagreement between the matched subjects are also provided in the table.

The results indicate that all of the matched pairs of subjects showed agreement on the processes either used or not used at least 55 percent of the time, which indicated that overall process usage was more similar than dissimilar. The percentage of agreement between the matched pairs varied from 55-85 percent. A score of 55 percent indicated that the matched subjects showed agreement on the same processes slightly more than half the time, while a score of 85 percent indicated that the pairs of subjects were even more similar in the processes they used or did not use. The subjects who demonstrated 55 percent agreement differed in both language and motor skills from those subjects who demonstrated 85 percent agreement. The percentages of agreement which were lowest among the matched subjects were demonstrated by the subject pairs 5, 6, 7, and 8. These eight subjects (four subject pairs) had motor scores which were among the lowest in their respective groups. However, the subjects had been matched on motor skills and while the low motor skills may have affected the nature of processes either used or not used by the pairs, they should not have affected the ability of each of the matched pairs of subjects to use (or not use) the same phonological processes. Therefore, the low percentage of agreement on phonological processes used by these four pairs of subjects

appeared to be due to differences in English language skills. As stated previously, the ESL counterparts of the pairs 5, 6, 7, and 8 had the lowest MLUs of that group. This indicated a lower level of expressive English language skills in those 4 subjects. Therefore, a major difference within each pair was in expressive language skills (as indicated by MLU). This indicated that the low percentage of agreement in phonological process production demonstrated by pairs 5, 6, 7, and 8 was probably due to the differences in expressive language skills, rather than to motor skills.

CHAPTER IV

DISCUSSION

The purpose of the present study was to examine the nature of phonological processes in children learning English as a first language as compared to Hmong children learning English as a second language. The results of the investigation indicated that overall the EFL and ESL subjects demonstrated agreement in both their use and non-use of phonological processes more than half the time. Further, the results indicated that the use of the same phonological processes by the subjects appeared to be more influenced by similar English language skills of the subjects than by similar motor skills.

In this chapter, the influence of language and motor skills on phonological process production are discussed as they relate to the results of the present study. Finally, limitations of the study, along with suggestions for future research are addressed.

LANGUAGE VS. MOTOR INFLUENCE

The consistency of phonological process production by the EFL subjects appeared to be related to the similar language skills of these subjects. The EFL subjects had

demonstrated normally developing speech and receptive language skills as part of the entry requirements of this study. Although the MLUs varied among the group, the receptive language skills of the subjects were considered to be within the range of normal. The motor skills of the group also varied, but as mentioned earlier, did not seem to account for the minor inconsistencies in phonological process use which were noted within this group. Therefore, the consistency of phonological process production appeared more closely related to the similar language skills of the subjects than to motor skills.

This study indicated a tendency by the EFL subjects to use the processes Cluster Reduction (CR), Sonorant Deviation (SD), and Prevocalic Voicing (PV). A review of the research investigating the nature of phonological processes in children learning English as a first language revealed contradictions regarding the use of processes by normally developing children. Research by Ingram (1981) also found that CR, SD, and PV occurred frequently in the speech of children who are developing language within normal limits. Shriberg and Kwiatkowski (1980) found that CR and SD were used by normally developing four year olds, but not PV. In contrast, research by Hodson and Paden (1981) indicated that only Liquid Deviation (a part of the Sonorant Deviation used in this study) occurred in the speech of normally developing four year olds, and that CR and PV were

used by four year old children whose speech was considered unintelligible. Depalatalization was used by three of the nine subjects in the EFL group, but Ingram (1981) found Depalatalization was not used by either normally developing or language delayed children. Shriberg and Kwiatkowski (1980) did not find Depalatalization in normally developing four year olds, while Hodson and Paden (1981) indicated this process was used by normally developing four year olds. Syllable Reduction (SR) was used by two of the EFL subjects, but this process was not found in the speech of normally developing children by either Ingram (1981) or Hodson and Paden (1981). SR was found to occur in the speech of normally developing children by Shriberg and Kwiatkowski (1980). The contradictory results from these studies may be attributed to several factors. One factor is that the studies involved subjects of varying ages. Ingram used subjects between 1;5 and 2;2 years. Hodson and Paden's subjects were between 4 and 5 years; Shriberg and Kwiatkowski reported on processes used by children aged 1;5 to 4 years of age. Further, these studies do not report longitudinal data on phonological process production, so use of processes over time is not known.

Another factor contributing to the contradictory results is that the various researchers may have used different criterion levels to determine the presence or absence of a phonological process. For example, in Hodson

and Paden's (1981) study, the criterion level was not stated, although they used Hodson's Assessment of Phonological Processes, which employs a 40 percent criterion level. The criterion level for determining the presence or absence is not stated by Ingram (1981) or Shriberg and Kwiatkowski (1980). The need for using a well-defined criterion level when examining the production of phonological processes in children was addressed by McReynolds and Elbert (1981). They compared the processes used by the subjects in their study on two different criteria; (1) a non-quantitative analysis, which stated only that the "child's error conform to the description of it" (p. 201), and (2) a quantitative analysis using a criterion level of twenty percent. Their results revealed that the number of processes decreased considerably when quantitative criteria were employed. The need to use, and clearly describe a criterion level for determining the presence or absence of a phonological process is crucial to the establishment of reliable normative data.

In the present study, two different criteria levels were employed, one involving a pre-determined criterion level of 40 percent, and the other based on a binomial distribution model. Hodson (1980) recommended the 40 percent criterion level as a means of distinguishing between children who would require speech and language remediation and those who would not. Since normal language development

was an entry requirement for the EFL subjects, the tendency of the subjects not to use phonological processes at or above that level was not considered unusual. Process use at the 40 percent level was demonstrated by approximately half the subjects in the ESL group which indicated that process use above that level was not uncommon among the subjects who were learning English as a second language. Therefore, the 40 percent criterion was found to be a reliable means of identifying problems in phonological development in children who are learning English as a first language. When applied to children learning English as a second language, the 40 percent criterion may be best used to identify children who need English language instruction, rather than intervention from a speech and language clinician for disordered language. Professionals in each community need to decide who is best qualified to provide English language instruction to those children who need it, such as those persons trained in English as a Second Language, or perhaps tutors from the community, etc. While the 40 percent criterion had certain benefits for the present study, it did not allow a close examination of the presence of phonological processes except at the pre-determined level. The research question posed in this study addressed the nature of phonological process production in the EFL and the ESL groups. This information was best provided by the analysis which was based on a binomial distribution model.

The ESL subjects demonstrated more variation in the use of phonological processes than the EFL subjects. Each subject in the ESL group used between 6-12 processes, which was twice as many as used by the subjects in the EFL group. As the descriptive data revealed, the language and motor skills of the ESL subjects were varied. Therefore, the inconsistency of phonological process production by these subjects could appear to be related to either or both language and motor skills. However, the subjects who were learning English as a first language also had varying motor skills, but did not demonstrate as much variation in phonological processes, which indicated that the inconsistency noted in the ESL subjects was more likely due to the level of expressive language functioning of these subjects than to the level of motor functioning per se.

Many of the processes used by both the EFL and the ESL subjects appeared to be related to simplification of later developing phonemes which are among the last to be acquired by normally developing children. For example, subjects in both groups demonstrated Cluster Reduction, Sonorant Deviation, Deaffrication, and Depalatalization. Cluster Reduction and Sonorant Deviation frequently involved omission of /l/ or /r/, while Deaffrication and Depalatalization involved substitutions for /tʃ/, /dʒ/, /ʃ/, and /ʒ/. These six phonemes have been shown to be among the last to be acquired by normally developing children

(Wellman, et. al., 1931; Templin, 1957; Sander, 1972; Prather, Hedrick, and Kern, 1975).

However, some of the phonological processes used by the ESL subjects cannot be attributed to later developing phonemes in English. Some of the processes used by the ESL subjects appeared to be related to what is known as "interference" in the English as a Second Language literature (Oksaar, 1975; Rouchdy, 1975; Bergman, 1976; Wode, 1977; Albert and Obler, 1978; Lindholm, 1978; Donegan and Stampe, 1979;). Interference is said to occur when aspects of the bilingual child's first language "interfere" with the acquisition of the second language. Although an in-depth analysis of the Hmong language was beyond the scope of this study, some aspects of that language are pertinent to this discussion. A list of the phonemes and other Hmong language characteristics as described by the Center of Applied Linguistics (General Information Series 14) is contained in Appendix F. In addition, although the present investigation was concerned with the phonological processes used by the ESL subjects, a phonetic segment analysis of English sounds which were used by the Hmong subjects is contained in Appendix G. Interference may have been a factor in the use of the process Syllable Reduction by five ESL subjects. Information obtained on the Hmong language revealed that it does not contain words of more than one syllable. Consequently, this aspect of their language may have

influenced the Hmong subjects to reduce polysyllabic words to monosyllables. Several items in The Assessment of Phonological Processes (Hodson, 1980) were used to elicit words which consisted of complex polysyllabic words such as "screwdriver" or "television." These words appeared to be very difficult for the Hmong children to produce. In addition to Syllable Deletion, five of the ESL subjects also demonstrated Postvocalic Devoicing and Stridency Deletion on word final consonants. Information obtained on the Hmong language indicated that the only consonant in the word final position is /ŋ/. Therefore, this characteristic of the Hmong language may have influenced the use of those two processes on word final consonants.

The ideal situation for professionals working with children who are learning English as a second language would be to have a thorough understanding of the child's first language (Carpenter, 1983). This would enable the professionals to be aware of those first language characteristics which may be interfering with the child's acquisition of English.

As discussed above, some phonological processes used by the ESL subjects appeared to be related to developmental factors, e.g., Cluster Reduction, Sonorant Deviation, Deaffrication, and Depalatalization. Other processes appeared to be more related to interference from the children's first language, e.g., Syllable Reduction, Postvocalic Devoicing,

and Stridency Deletion. This conclusion is in agreement with that of a study on acquisition on second language phonology by Hecht and Mulford (1982). They found that second language phonological acquisition depends both on developmental factors and the child's phonological knowledge of the first language. Further research in this area is needed.

The results of the present study indicated that all of the matched pairs of subjects showed agreement in their use and non-use of phonological processes at least half the time. The descriptive data revealed that the ability of the pairs to use (or not use) the same processes appeared to be more closely related to similar expressive language skills of the pairs, rather than to similar motor skills.

According to the transformational theory of Chomsky and Halle (1968), the sounds that children acquire and use are determined by the children's linguistic background. The consistency and limited use of phonological process production by the EFL group were considered to have been related to the normally developing language skills of those subjects. The ESL subjects demonstrated a much wider range of variability of phonological process use, and again, this appeared to be related to the varying expressive English language skills of those subjects. Further, the ESL subjects used more processes than the EFL subjects, and this appeared to be related to the linguistic background, or

bilingual characteristics of the Hmong subjects. Finally, the ability of the matched pairs of subject to demonstrate the same processes, both through use and non-use, appeared to be more influenced by language factors than by motoric factors. The results of the present study indicated that the use of phonological processes is largely influenced by linguistic functioning of the children. The findings of this study support the transformational theory with regard to language acquisition.

Jakobson (1968) proposed that different children learning different language follow a similar pattern of phonological development due to similarities in motor development. Variation in motor skills in both the EFL and ESL groups did not appear to influence the use of phonological processes by those subjects. The similarity in motor skills between the matched subjects may have influenced the production of certain phonological processes, but did not account for the use of certain other processes, thus, the results of the present study did not uniformly substantiate Jakobson's claims. Jakobson does not directly address age factors in his book Child Language, Aphasia, and Phonological Universals (1968), although he emphasized the production of childrens' earliest sounds. The subjects in the present study were between four and five years of age which may be older than the age range to which Jakobson's concepts were to be applied.

Stampe's (1969) theory postulated that children use phonological processes during language acquisition to simplify the sound system. As the child's language becomes more similar to the adult model, the number of phonological processes decrease. In the ESL group in this study, the greatest number of phonological processes were demonstrated by children with the lowest MLUs. Subjects at a higher level of language development (as determined by MLU) used fewer phonological processes. This aspect of the present study's results support Stampe's theory on the use of phonological processes in children.

LIMITATIONS IN THE STUDY AND SUGGESTIONS FOR FUTURE RESEARCH

The results of the present study indicated children's language skills influence the phonological processes employed. The results of the present study would have been strengthened by the addition of a third group of subjects composed of Hmong children who were matched on the basis of language skills to the EFL group. The addition of this group would have enabled additional interpretation on the influence of language on phonological process use. Also in this study, the four ESL subjects who used the most phonological processes had both the lowest MLUs and motor scores in their group. This may have been coincidence, but may indicate that motor skills and language skills are more closely related as advocated by Lenneberg (1967). Future

researchers may wish to examine this relationship by comparing an aspect of language production in children with varying levels of motor functioning.

The present study would have been strengthened if there had been more subjects in each group. The number of subjects in this study was small due to the limited number of Hmong children who were living in the same geographical area and who met the minimum English language entry criteria. In addition, some children were eliminated from the study due to physical or hearing problems, or because of an unwillingness to participate in the study.

If the responses of the subjects had been analyzed by a linguist familiar with the Hmong language, additional phonological processes probably would have been identified. Transcription by an experienced linguist who was familiar with Hmong may have allowed the identification of linguistically influenced processes, and motorically influenced processes. Furthermore, utilization of spectrographic analysis of the subjects' responses may have yielded more objective (i.e., non-perceptually based) data.

The manner in which words were elicited from the subjects may have also influenced the results of the present study. Objects from The Assessment of Phonological Processes (Hodson, 1980) were used to obtain words as the basis from which to assess the presence or absence of a phonological process. Although this instrument was

originally selected because the objects were assumed to be those with which the subjects in both groups would be familiar, the Hmong subjects seemed to be much less familiar with the objects than expected. Although specific data were not collected, the examiner had to name items for the ESL subjects on numerous occasions. Some of the ESL subjects were not able to repeat the label when a carrier phrase (e.g., "Now you say it,") was inserted. The selection of items with which the Hmong subjects were more familiar would have ensured that the words were part of the Hmong children's English vocabulary.

The manner in which the processes were defined in The Assessment of Phonological Processes (Hodson, 1980) was of concern. Certain processes as defined by Hodson included too many sounds to be really beneficial for examining the children's speech sounds and sound patterns. For example, the process of Sonorant Deviation included all deviations for /l/ and /r/, glides, nasals, and all vowels. This category was so comprehensive that the subjects' actual productions of specific phonemes, i.e., liguids, were obscured. Another example of a poorly defined process was Prevocalic Voicing. This process was used by most of the subjects in both groups and appeared to be related to coarticulatory aspects which occur normally in speech. For example, in The Assessment of Phonological Processes, Hodson (1980) targeted the word "sweater" as /swɛtɝ/. Most of the

subjects in this study produced this word as /swɛdɝ/, which is identical to the general American adult pronunciation. Therefore, the use of Prevocalic Voicing in this instance should not have been considered abnormal.

GENERAL CONCLUSION AND IMPLICATIONS

In conclusion, the results of the present study indicated that the subjects who were learning English as a first language and as a second language demonstrated agreement in both use and non-use of phonological processes at least half the time. Further, the study found that the use of phonological processes appeared to be more closely related to the level of language functioning of the subjects than to the level of motor functioning. The implications of this study are that (1) children learning English as a second language tend to use more phonological processes than children learning English as a first language, and (2) children who are learning English as a second language may need instruction in English language proficiency rather than speech and language remediation for problems in phonological development.

APPENDICES

APPENDIX A

Phonological Processes which have been used by other Researchers

Oller and Warren, 1975

1. Cluster Simplification
2. Final Consonant Deletion
3. Assimilation
4. Substitution
   - A. Collapsing of two or more phonetic or phonemic categories
   - B. Devoicing
   - C. Stopping

Weiner, 1979

1. Syllable structure processes
   - A. Deletion of final consonants
   - B. Cluster reduction
   - C. Weak syllable deletion
   - D. Glottal replacement

2. Harmony processes
   - A. Labial assimilation
   - B. Alveolar assimilation
   - C. Velar assimilation
   - D. Prevocalic voicing
   - E. Final consonant devoicing
   - F. Manner harmony
   - G. Syllable harmony

3. Feature Contrast Processes
   - A. Stopping
   - B. Affrication
   - C. Fronting
   - D. Gliding of fricatives
   - E. Gliding of liquids
   - F. Vocalization
   - G. Denasalization
   - H. Neutralization

Shriberg and Kwiatkowski, 1980

1. Final Consonant Deletion
2. Velar Fronting
3. Stopping
4. Palatal Fronting
5. Liquid Simplification
6. Regressive and Progressive Assimilation
7. Cluster Reduction
8. Unstressed Syllable Deletion

Ingram, 1981

1. Syllable Structure Processes
   - A. Deletion of Final Consonants
   - B. Reduction of Consonant Clusters
   - C. Syllable Deletion and Reduplication

2. Substitution Processes
   - A. Fronting
   - B. Stopping
   - C. Simplification of Liquids and Nasals
   - D. Deaffrication
   - E. Deletion of Initial Consonants
   - F. Apicalization
   - G. Labialization

3. Assimilation Processes
   - A. Velar Assimilation
   - B. Labial Assimilation
   - C. Prevocalic Voicing
   - D. Devoicing of Final Consonants

APPENDIX B

Descriptions of Phonological Processes

Taken from The Assessment of Phonological Processes (Hodson, 1980)

1. Syllable Reduction occurs in a word with two or more syllables when one or more of the syllables is deleted.

2. Cluster Reduction occurs when one or more consonant member(s) of a cluster is omitted.

3. Obstruent Singleton Omission, prevocalic and postvocalic. This occurs when an obstruent is omitted, either in the prevocalic or postvocalic position.

4. Stridency Deletion occurs when a strident phoneme is totally omitted, or when a non-strident phoneme is substituted in place of a strident phoneme.

5. Velar Deviation occurs when anterior phonemes such as /t/, /d/, /n/, /p/, /b/, or /m/ are substituted for the velar phonemes /k/, /g/, and /ŋ/, or when the velar phoneme is completely omitted.

6. Prevocalic Voicing occurs when voicing is added to a voiceless target phoneme when it precedes a vowel.

7. Postvocalic Devoicing occurs when a voiced target phoneme is devoiced.

8. Glottal Replacement occurs when glottal stops are substituted for other phonemes.

9. Backing occurs when velar phonemes or glottal stops are substituted for non-back target phonemes.

10. Stopping occurs when stop phonemes are substituted for sibilants or liquids.

11. Affrication occurs when affricate phonemes are substituted for non-affricates.

12. Deaffrication occurs when affricates are omitted, or when other phonemes are substituted in place of affricates.

13. Palatalization occurs when palatalization is added to target non-palatal phonemes.

14. Depalatalization occurs when other phonemes are substituted for the palatal phonemes.

15. Coalescence occurs when another phoneme is used in place of two others with whom it shares certain aspects, e.g., voicing, place or manner of articulation.

16. Epenthesis occurs when another phoneme is inserted between two target phonemes.

17. Metathesis occurs when positions of phonemes or syllables are changed.

18. Sonorant Deviations include all deviations or substitutions for liquids, nasals, vowels, and glides.

19. Assimilation includes both regressive and progressive assimilation of nasals, velars, labials, and alveolars.

20. Articulatory Shifts includes substitutions of /f, v, s, z/ for /θ/ or /ð/, frontal lisps, dentalization of /t, d, n, l/ and lateralization of any phoneme.

APPENDIX C

Description of the Motor Subtests

Taken from the McCarthy Scales of Children's Abilities (McCarthy, 1972)

SUBTEST 9. Leg Coordination

1. Walking Backwards The child walks backward after a demonstration by the examiner.

> Scoring: 2 points for 5 or more steps, each of which is longer than the child's own foot. The child must lift his feet from the floor and his arms should not be waved for balance.
> 1 point for 2-4 steps, for sliding or shuffing steps, or poor balance.
> 0 points for inability to take more than 1 step backward.

2. Walking on Tiptoe. The child walks on tiptoe after demonstration by the examiner.

> Scoring: 2 points for good performance (i.e., 5 or more steps covering a distance of at least 2 feet without touching heels to floor).
> 1 point for partially successful performance (i.e., 2-4 steps without touching heels to floor, or 5 or more steps covering less than 2 feet).
> 0 points for inability to stand on tiptoe or to cover any distance on tiptoe.

3. Walking a Straight Line.. Child walks along a 9 ft length of tape secured to the floor.

> Scoring: 2 points for good balance and all steps on tape.
> 1 point for some imbalance and no more than 2 steps off tape.

0 points for poor balance and 3 or more steps off the tape.
To receive any credit, the child has to walk the entire length of the tape.

4. Standing on One Foot. The child stands on one foot (his preference) for as long as possible.

Scoring: 2 points for standing on one foot for 10 seconds or more.
1 point for standing 3-9 seconds.
0 points for standing 0-2 seconds.

5. Standing on Other Foot. Child stands on opposite foot from that in task number 4 for as long as possible.

Scoring: 2 points for standing on one foot for 10 seconds or more.
1 point for standing 3-9 seconds.

6. Skipping. Child demonstates skipping ability on command.

Scoring: 3 points if child skips rhythmically using alternating feet for skipping.
2 points if he skips 2 or 3 times with only one foot and not the other.
1 point if he hops on one foot 2 or 3 times.
0 points if he stands still, jumps with both feet simultaneously, gallops, or runs.

SUBTEST 10. Arm Coordination

Part I. Ball Bouncing. Child bounces ball with the palm of one hand, without catching it between bounces, after demonstration by examiner.

Scoring: The following table was used to convert the number of bounces to a score.

Number of bounces	Score
15	7
12-14	6
9-11	5
6-8	4
3-5	3
2	2
1	1
0	0

Part II. Beanbag Catch Game.

The child stands at one end of a 9 foot length of tape and the examiner stands at the other.

1. The child demonstrates catching ability by catching a beanbag with both hands. Three trials. Proceed with item 2 only if child catches beanbag at least once.

Scoring: 1 point for each catch (with one or both hands).

2. The child demonstrates catching with one hand (his preference).

Scoring: 1 point for each catch.

3. The child demonstrates catching with the opposite hand.

Scoring: 1 point for each catch.

Part III. Beanbag Target Game

Target is placed on floor 6 feet from child, at a 45 degree angle.

1. Child throws beanbag through target with one hand (his preference). Three trials.

Scoring: 2 points for each time the beanbag, thrown by the preferred hand, goes through the hole or hangs in the hole without going through.
1 point for each time the beanbag, thrown by the preferred hand, hits the target board but does not go in the hole.
If the beanbag touches the wall or floor and then hits the target, the trial is scored 0.

SUBTEST 11. Imitative Action

1. Child crosses feet at the ankles upon demonstration and prompting by the examiner.

Score: 1 point for correct imitation, regardless of which foot is on top.

2. Child folds hands on the table upon demonstration and prompting by the examiner.

Score: 1 point for correct imitation, regardless of which thumb is on top.

3. Child twiddles thumbs (rotates them) upon demonstration and prompting by the examiner.

Score: 1 point for correct imitation

4. Child looks through paper tube upon demonstation and prompting by the examiner.

Score: 1 point if the child picks up the tube with one or both hands and looks through it with one eye (either right or left). The covering paper must be touching or almost touching his face.
0 points for any other response.

SUBTEST 12. Draw-a-design

1. Child draws a circle approximately 1 inch in diameter after demonstration by examiner.

Scoring criteria: Score 1 if both of the criteria are met.

Score 0 if only one (or neither) of the criteria is met.
A. The drawing is a curved figure, even if heart shaped, apple-shaped, etc. It may be a circle that wraps around itself, or one where the starting and/or finishing points lie outside the circle. Do not credit a circle which contains scribbled lines.
B. The circle is at least 3/4 closed.

2. The child draws a vertical line, approximately 1-1/2 inches long after demonstration by the examiner.

Scoring criteria: Score 1 if both of the criteria are met.
Score 0 if only one (or neither) of the above criteria are met.
A. The line is approximately vertical (i.e., it varies from the vertical by not more than 30 degrees) but it may be slightly curved or broken.
B. The line measures at least 1/4 inch and is no longer than twice the length of the examiner's sample.

3. The child draws a horizontal line approximately 1-1/2 inches long after a demonstration by the examiner.

Scoring criteria: Score 1 if both the criteria are met.
Score 0 if only one (or neither) of the criteria are met.
A. The line is approximately horizontal (i.e., it varies from the horizontal by not more than 30 degrees) but it may be slightly curved or broken.
B. The line measures at least 1/4 inch and is no longer than twice the length of the examiner's sample.

4. The child draws a right angle on a page which has a model of a right angle on it.

Scoring criteria: If all three of the minimum criteria are met, the drawing receives an initial credit of 1 point.
If only two (or less) or the above criteria are met, the score is zero.

Minimum criteria

A. The angle is within the range of 70-110 degrees.
B. At least one line is straight.
C. Any gap or overlap at the intersection does not exceed 1/8 inch.

Additional scoring criteria: If all three of the additional criteria are met, the drawing receives 1 additional point, making a total score of 2 points. If only two (or less) or the Additional Criteria are met, give no additional credit; the score remains 1 point.

Additional criteria

A. The angle is approximately 90 degrees.
B. The lines are about the same length (i.e., one line is no more than 1-1/2 times as long as the other), and both lines are straight.
C. The figure is positioned approximately like the model, i.e., any existing rotation is less than 30 degrees.

5. The child draws a figure of three intersecting lines on a page which has a model of the figure on it.

Scoring criteria: If all of the minimum criteria are met, the drawing receives an initial credit of 1 point.
If only two (or less) of the minimum criteria are met, the score is zero.

Minimum criteria

A. There are 5 to 8 rays.
B. The rays form an asterisk-like pattern, whether drawn with intersecting lines, with rays meeting at a central point, or with rays drawn to the central portion of a straight line.
C. The rays are fairly straight.

Additional scoring criteria: If all three of the additional criteria are met, the drawing receives 1 additional point -- making a score of 2 points.

Additional criteria

A. There are exactly 6 rays of about the same length, i.e., the longest ray is not more than twice the length of the shortest ray.
B. The 6 angles are fairly equal, i.e., there is no angle more than 90 degrees or less than 30 degrees.

C. The drawing is constructed from 3 intersecting lines which meet - or almost meet - at a single point.

6. The child draws a figure of two intersecting circles with a small line at the intersection on a page which has a model of this figure on it.

Scoring criteria: If all of the minimum criteria are met, the drawing receives an initial credit of 1 point.
If only two (or less) of the above criteria are met, the score is zero.

Minimum criteria

A. There are two intersecting circular or oval shapes. They may be poorly drawn but must be more curved than angular. One shape may be much larger than the other.
B. The area of overlap created by the intersection is no larger than the remaining portion of either of the shapes.
C. At the area of overlap, there are no embellishments such as small circles. There is no penalty if the short horizontal line is missing or is drawn vertically. Nor is there a penalty if an extra line is added.

Additional scoring criteria

If all four of the additional criteria are met, the drawing receives 2 additional points - making a score of 3 points.
If two or three of the additional criteria are met, the drawing receives 1 additional point - making a score of 2 points.
If only one (or none) of the additional criteria is met, give no additional credit; the score remains 1 point.
A. The 2 intersecting shapes are well drawn and are more nearly circular than oval.
B. The 2 intersecting shapes are of approximately equal size.
C. The area of overlap is markedly smaller than the remaining portion of either of the shapes.
D. A short horizontal line approximately bisects the area of overlap, is largely contained within it, and no other lines are drawn in that area. Furthermore, this horizontal line -- if extended

across the entire figure -- would divide each of the circles into approximately equal halves.

There were three other figures in this subtest, but none of the subjects was able to gain any points from their drawings, and therefore, those three figures will be omitted from this appendix.

SUBTEST 13. Draw-a-child

The child draws the figure of a person upon request from the examiner. Each part of the figure is scored individually, and these scoring criteria are listed below.

HEAD. 2 points: there is a head and its general shape is that of an oval in a vertical position -- that is, with its height greater than its width. 1 point: there is a head but it does not resemble an oval in a vertical position. Typical 1 point responses are circles, and ovals in a horizontal position. Also give 1 point for irregularly-shaped closed figures. 0 points: if no head is indicated.

HAIR. 2 points: Hair is indicated on the head and is neatly drawn, even if not shaded in. 1 point: Hair is indicated but is not drawn neatly. Give 1 point even if crudely drawn. 0 points: no hair is indicated.

EYES. 2 points: There are two eyes (one if face is in profile), and each eye shows either eyebrows, lashes, or pupils. 1 point: There are two eyes, but no eyebrows, lashes, or pupils. Give 1 point to dots or any other crude representation of eyes. 0 points: Only one eye is indicated (in a full-face drawing), or there are no eyes, or there are more than two.

NOSE. 2 points: There is a nose and it is shown in two dimensions, the line indicating the height being longer than the width of the tip. 1 point: A nose is shown in either one or two dimensions. Give one point to a dot or any other crude representation of a nose, or a two-dimensional nose with the height

not longer than the width of the tip. 0 points: no nose is indicated.

MOUTH. 2 points: there is a mouth, and 1 or 2 lips are clearly indicated. 1 point: there is a mouth, but lips are not shown. 0 points: no mouth is indicated, or there is only a dot where the mouth should be.

NECK. 2 points: there is a neck, indicated by two vertical lines, and its outline is continuous with that of the head or the truck or both. If the neck joins a collar or a dress, it is considered to be continuous with the trunk, and it therefore deserves 2 points. 1 point: there is a neck, shown by either one or two lines, but it is not continuous with either the head or the trunk. In the case of a stick figure, give 1 point if a neck and shoulders are both present. 0 points: no neck is indicated.

TRUNK. 2 points: there is a trunk and its length is clearly greater than its width. 1 point: there is a trunk, but its length is not clearly greater than its width. 0 points: no trunk is indicated.

ARMS AND HANDS. 2 points: there are two arms and two hands. Hands may be indicated in any manner. 1 point: there are two arms, but no hands. 0 points: only one arm is indicated, or there are no arms, or there are more than two.

ATTACHMENT OF ARMS. 2 points: two shoulders and arms are clearly indicated; the arms are two-dimensional and are attached at the appropriate places. 1 point: Arms, but no shoulders are indicated; the arms, even if only uni-dimensional, are attached to the upper part of the trunk at approximately the correct points. 0 points: the attachment of both arms does not meet any of the above criteria.

LEGS AND FEET. 2 points: there are two legs and two feet. Feet may be indicated in any manner. 1 point: there are two legs, but no feet (or only one) are indicated. 0 points: only one leg is indicated (unless the figure in profile), or there are no legs, or there are more than two.

APPENDIX D

Raw Data on Subjects' Responses Obtained on The Assessment of Phonological Processes (Hodson, 1980)

EFL Subject 1

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛɚplein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskət/	quarter	/kwoɚtɚ/	/kordɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruʒ/
candle	/kændl̩/	/kændl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæntəˌklɔz/	/sʌnəklaz/
cowboy hat	/kaʊboiˌhæt/	/kaboi hæt/	screw-driver	/skrudraivɚ/	/skrudraivɚ/
crayons	/kreiənz/	/kreiənz/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/slɛd/
black	/blæk/	/blæk/	smooth	/smuð/	/smuð/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlo/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/sprIŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skwɝl/
flower	/flaʊwɚ/	/flaʊwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/strIŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swetɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləˌvIʒən/	/tɛlavɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/ðæt/
hanger	/hæŋɚ/	/hæŋɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hoɚs/	tooth-brush	/tuθˌbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɑIskjubz/	/aɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmpˌroʊp/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/wats/
mouth	/maʊθ/	/maʊθ/	yoyo	/joʊjoʊ/	/joujo/
music box	/mjuzIkˌbaks/	/muzɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/noʊz/	/noz/			

EFL Subject 2

Word	Target	Response	Word	Target	Response
airplane	/ɛɹplein/	/ɛɹplein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskət/	quarter	/kwoɹtɹ/	/koɹdɹ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruʒ/
candle	/kændl̩/	/kændəl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɹ/	/tʃɛɹ/	Santa Claus	/sæntəklɔz/	/sæntəklaz/
cowboy hat	/kauboihæt/	/kaboi hæt/	screw-driver	/skrudraivɹ/	/skrudraivɹ/
crayons	/kreiənz/	/kreijan/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuθ/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jelou/	soap	/soup/	/sop/
doll	/dal/	/dali/	spoon	/spun/	/spun/
feather	/fɛðɹ/	/fɛðɹ/	spring	/sprIŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪʃi/	squirrel	/skwɝl/	/skwɝl/
flower	/flauwɹ/	/flauwɹ/	star	/staɹ/	/staɹ/
fork	/fɔɹk/	/foɹk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæzəz/	sweater	/swɛtɹ/	/swɛdɹ/
glove	/glʌv/	/glʌvz/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/ðæt/
hanger	/hæŋɹ/	/heiŋɹ/	thumb	/θʌm/	/θʌm/
horse	/hɔɹs/	/hoɹsi/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/ɹɪskjub/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmpɪŋrop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæs/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musɪkbaks/	zipper	/zIpɹ/	/zɪpɹ/
nose	/nouz/	/noz/			

EFL Subject 3

Word	Target	Response	Word	Target	Response
airplane	/ɛɹplein/	/ɛɹplein/	page	/peidʒ/	/peitʃ/
basket	/bæskIt/	/bæskət/	quarter	/kwoɹtɚ/	/koɹdɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/rudʒ/
candle	/kændl̩/	/kæno/	rug	/rʌg/	/rʌg/
chair	/tʃɛɹ/	/tʃɛɹ/	Santa Claus	/sæntəklɑz/	/sæneklaz/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skrudraivɚ/
crayons	/kreiənz/	/kræənz/	shoe	/ʃu/	/ʃu/
three	/θri/	/fri/	sled	/slɛd/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɜl/	/skɜl/
flower	/flauwɚ/	/flauwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɹk/	/foɹk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/hæŋgɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɹs/	/hoɹsi/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/ɑɪskjub/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæks/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/muzɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

EFL Subject 4

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛɚplein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskət/	quarter	/kwɔɚtɚ/	/kɔɚɾɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruʒ/
candle	/kændl/	/kændol/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæntəklɑz/	/sændəklaz
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skudrɑivɚ/
crayons	/kreiənz/	/krɛnz/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/slɛd/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dali/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/sprIŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skwɝl/
flower	/flauwɚ/	/flauwɚ/	star	/stɑɚ/	/stɑɚ/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛɾɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/hæŋkɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hɔɚsi/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/aɪskjub/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

EFL Subject 5

Word	Target	Response	Word	Target	Response
airplane	/ɜɹplein/	/ɛɹplein/	page	/peidʒ/	/peiɕz/
basket	/bæskIt/	/bæskət/	quarter	/kwɔɹtɹ/	/kɔɹdɹ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruts/
candle	/kændl̩/	/kændəl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɹ/	/tsɛɹ/	Santa Claus	/sæntəklɔz/	/sɛntə̃k'az/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɹ/	/skudraivɹ/
crayons	/kreiənz/	/krænz/	shoe	/ʃu/	/su/
three	/θri/	/θri/	sled	/slɛd/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɹ/	/fɛðɹ/	spring	/sprɪŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪs/	squirrel	/skwɜl/	/skwɜl/
flower	/flauwɹ/	/flauwɹ/	star	/stɑɹ/	/staɹ/
fork	/fɔɹk/	/fɔɹk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɹ/	/swɛdɹ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪzəŋ/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɹ/	/heiŋɹ/	thumb	/θʌm/	/θʌm/
horse	/hɔɹs/	/hoɹs/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌs/
ice cubes	/ɔIskjubz/	/ɑrskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/tʃʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/wats/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mjuzIkbaks/	zipper	/zIpɹ/	/zɪpɹ/
nose	/nouz/	/noz/			

EFL Subject 6

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛɚplein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskət/	quarter	/kwɔɚtɚ/	/kɔɚdɚ/
bed	/bɛd/	/bed/	rouge	/ruʒ/	/ruʒ/
candle	/kændl/	/kænd!/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃeiɚ/	Santa Claus	/sæntəklɔz/	/senəklaz/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skrudrəivɚ/
crayons	/kreiənz/	/krəenz/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/slɛd/
black	/blæk/	/blæk/	smooth	/smuð/	/smuð/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/sprIŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɜl/	/skwɜl/
flower	/flauwɚ/	/fləuwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/ðæt/
hanger	/hæŋɚ/	/hæŋɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hɔɚs/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/ɑɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/liv/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mjuzɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

EFL Subject 7

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛɚ ein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskɪt/	quarter	/kwɔɚtɚ/	/kwɔɚtɚ/
bed	/bed/	/bɛd/	rouge	/ruʒ/	/ruʒ/
candle	/kændl/	/kændl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃeiɚ/	Santa Claus	/sæntəklɑz/	/sɛnəklaz/
cowboy hat	/kauboihæt/	/kaboi hæt/	screw-driver	/skrudraivɚ/	/skrudraivɚ/
crayons	/kreiənz/	/krænz/	shoe	/ʃu/	/ʃu/
three	/θri/	/fri/	sled	/slɛd/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛdɚ/	spring	/sprIŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɜl/	/skwɜl/
flower	/flauwɚ/	/flauwɚ/	star	/stɑɚ/	/stɑɚ/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/ðæt/
hanger	/hæŋɚ/	/heiŋgɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hoɚs/	tooth-brush	/tuθbrʌʃ/	/tufbrʌʃ/
ice cubes	/ɔIskjubz/	/ɑɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/liv/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/muzɪk baks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

EFL Subject 8

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	'ɛɚplein/	page	/peidʒ/	'peidʒ'
basket	/bæɚskIt/	/bæɚskət/	quarter	/kwɔɚtɚ/	/koɚdɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruʒ/
candle	/kæɚndl̩/	/kæɚndl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæɚntəklɔz/	/sæɚnəklaz'
cowboy hat	/kauboihæɚt/	/kauboihæɚt/	screw-driver	/skrudraivɚ/	/skrudraivɚ'
crayons	/kreiənz/	/krəɚnz/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/sled/
black	/blæɚk/	/blæɚk/	smooth	/smuə/	/smuθ/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛ ðɚ/	spring	/sprIŋ/	/sprIŋ/
fish	/fIʃ/	/fIʃ/	squirrel	/skwɝl/	/skɝl/
flower	/flauwɚ/	/flauɚ/	star	/staɚ/	/star/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/strIŋ/
glasses	/glæɚsIz/	/glæɚzəz/	sweater	/swɛtə/	/swɛdə/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvIʒən/
gun	/gʌn/	/gʌn/	that	/ðæɚt/	/ðæɚt/
hanger	/hæŋɚ/	/hæŋɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hoɚs/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/əɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmpɪŋrop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veiz/
mask	/mæɚsk/	/mask/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	'noz'			

EFL Subject 9

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛɚplein/	page	/peidʒ/	/pɛʧ/
basket	/bæskIt/	/bæskət/	quarter	/kwɔɚtɚ/	/kwɔɚɾɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/ruz/
candle	/kændl/	/kændəl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/ʧɛɚ/	Santa Claus	/sæntklɔz/	/sænklaz/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skrudraivɚ/
crayons	/kreiənz/	/kræənz/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/sled/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuð/
green	/grin/	/grin/	snake	/sneik/	/snek/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/spriŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skwɜl/
flower	/flauwɚ/	/flauwɚ/	star	/stɑɚ/	/staɚ/
fork	/fɔɚk/	/foɚk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛɾɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/ðæt/
hanger	/hæŋɚ/	/hæŋɚ/	thumb	/θʌm/	/θʌm/
horse	/hɔɚs/	/hɔɚs/	tooth-brush	/tuθbrʌʃ/	/tuθbrʌʃ/
ice cubes	/ɔIskjubz/	/aɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mjuzɪkbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

ESL Subject 1

Word	Target	Response	Word	Target	Response
airplane	/ɛɹplein/	/ɛplein/	page	/peidʒ/	/peitʃ/
basket	/bæskIt/	/bæsket/	quarter	/kwɔɹtɚ/	/kwoɹdɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/rudʒ/
candle	/kændl/	/kændəl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɹ/	/tʃɛɹ/	Santa Claus	/sæntəklɔz/	/sænəklaz/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skudraivə/
crayons	/kreiənz/	/kren/	shoe	/ʃu/	/ʃu/
three	/θri/	/tri/	sled	/slɛd/	/slɛd/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/gwin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛdɚ/	spring	/sprIŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skwəl/
flower	/flauwɚ/	/flauwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɹk/	/foɹk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/gəlæs/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛvɪzɛnz/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/heingɚ/	thumb	/θʌm/	/təm/
horse	/hɔɹs/	/hoɹsi/	tooth-brush	/tuθbrʌʃ/	/tutbrʌʃ/
ice cubes	/ɔIskjubz/	/aɪskjub/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veis/
mask	/mæsk/	/mæks/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mosɪk baks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

ESL Subject 2

Word	Target	Response	Word	Target	Response
airplane	/ɛəplein/	/ɛəplein/	page	/peidʒ/	/peits/
basket	/bæskIt/	/bæskət/	quarter	/kwɔətə/	/kwɔədə/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/rub/
candle	/kændl/	/kænd!/	rug	/rʌg/	/rʌg/
chair	/tʃɛə/	/tʃɛə/	Santa Claus	/sæntəklɔz/	/sænklaz/
cowboy hat	/kauboihæt/	/kaboi hæ/	screw-driver	/skrudraivə/	/skudraivə/
crayons	/kreiənz/	/kraen/	shoe	/ʃu/	/ʃu/
three	/θri/	/θri/	sled	/slɛd/	/slɛd/
black	/blæk/	/blaek/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dali/	spoon	/spun/	/spun/
feather	/fɛðə/	/bɛðə/	spring	/sprIŋ/	/spret/
fish	/fIʃ/	/pʃ/	squirrel	/skwɜl/	/skwɜəl/
flower	/flauwə/	/flauə/	star	/stɑə/	/staə/
fork	/fɔək/	/poək/	string	/strIŋ/	/strIŋ/
glasses	/glæsIz/	/glaesəz/	sweater	/swɛtə/	/swɛdə/
glove	/glʌv/	/glʌb/	tele-vision	/tɛləvIʒən/	/tɛlabrʒən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/daet/
hanger	/hæŋə/	/heiŋə/	thumb	/θʌm/	/tʌm/
horse	/hɔəs/	/hɔəs/	tooth-brush	/tuθbrʌʃ/	/tufbrʌʃ/
ice cubes	/ɔIskjubz/	/aIskjub/	truck	/trʌk/	/traek/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lip/	vase	/veis/	/weis/
mask	/mæsk/	/mæs/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mjuzIkbak/	zipper	/zIpə/	/zIpə/
nose	/nouz/	/nõz/			

ESL Subject 3

Word	Target	Response	Word	Target	Response
airplane	/ɛɹplein/	/ɛɹplein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskɪts/	quarter	/kwɔɹtɚ/	/kwoɹdɚz/
bed	/bɛd/	/bɛ/	rouge	/ruʒ/	/ruʒ/
candle	/kændl/	/kændoz/	rug	/rʌg/	/rʌg/
chair	/tʃɛɹ/	/tʃɛɹ/	Santa Claus	/s æntəklɔz/	/sæŋklaz/
cowboy hat	/kauboihæt/	/kaboihaet/	screw-driver	/skrudraivɚ/	/ʃuʃdrɪɪbɚ/
crayons	/kreiənz/	/kræn/	shoe	/ʃu/	/ʃuz/
three	/θri/	/tri/	sled	/slɛd/	/ʃwep/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sops/
doll	/dal/	/dal/	spoon	/spun/	/spwn/
feather	/fɛðɚ/	/fɛðɚz/	spring	/sprɪŋ/	/sprɪŋg/
fish	/fIʃ/	/ftʃ/	squirrel	/skwɝl/	/skɔɚlz/
flower	/flauwɚ/	/flæuwɚ/	star	/stɑɚ/	/staɚ/
fork	/fɔɚk/	/foɚz/	string	/strIŋ/	/strɪŋg/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛdɚz/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛʌvɪʃən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/hæŋgɚ/	thumb	/θʌm/	/sʌm/
horse	/hɔɚs/	/hoɚs/	tooth-brush	/tuθbrʌʃ/	/tufbrʌʃ/
ice cubes	/ɔIskjubz/	/ɚɪsɪubz/	truck	/trʌk/	/trʌks/
jump rope	/dʒʌmproup/	/dʒʌmpɪŋ rok/	tub	/tʌb/	/tʌb/
leaf	/lif/	/livz/	vase	/veis/	/veivz/
mask	/mæsk/	/mæs/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musi baks/	zipper	/zIpɚ/	/zɪpɚz/
nose	/nouz/	/noz/			

ESL Subject 4

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛ'plein/	page	/peidʒ/	/peidʒ/
basket	/bæskIt/	/bæskət/	quarter	/kwɔɚtɚ/	/kordɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/rudʒ/
candle	/kændl/	/kændə/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæntəklɔz/	/sæənəklaz/
cowboy hat	/kauboihæt/	/kaboihæt/	screw-driver	/skrudraivɚ/	/skuɹɑɪvɚ/
crayons	/kreiənz/	/krɑun/	shoe	/ʃu/	/ʃuz/
three	/θri/	/θri/	sled	/slɛd/	/θlɛd/
black	/blæk/	/blæk/	smooth	/smuð/	/θmuv/
green	/grin/	/grin/	snake	/sneik/	/θneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/dali/	spoon	/spun/	/spun/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprIŋ/	/spɹɪŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skɝl/
flower	/flauwɚ/	/flðwɚ/	star	/stɑɚ/	/θtaɚ/
fork	/fɔɚk/	/fɔɚk/	string	/strIŋ/	/stɹɪŋg/
glasses	/glæsIz/	/glæsəz/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌv/	tele-vision	/tɛləvIʒən/	/tɛləvɪzən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/hæŋg/	thumb	/θʌm/	/tʌm/
horse	/hɔɚs/	/hoɚsi/	tooth-brush	/tuθbrʌʃ/	/tufbɹʌʃ/
ice cubes	/ɔIskjubz/	/ɑɪskuz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmprop/	tub	/tʌb/	/tʌvz/
leaf	/lif/	/liv/	vase	/veis/	/veidʒ/
mask	/mæsk/	/mæes/	watch	/watʃ/	/wɑtʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/muzɪks baks/	zipper	/zIpɚ/	/zɪp/
nose	/nouz/	/noz/			

ESL Subject 5

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/emplen/	page	/peidʒ/	/pidʒ/
basket	/bæskIt/	/bakas/	quarter	/kwɔɚtɚ/	/koɚdɚ/
bed	/bɛd/	/bɛs/	rouge	/ruʒ/	/ruz/
candle	/kændl/	/kɔeno/	rug	/rʌg/	/ra/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæntəklɔz/	/senaka/
cowboy hat	/kauboihæt/	/kaboi hæt/	screw-driver	/skrudraivɚ/	/kuc ɑɪbə/
crayons	/kreiənz/	/kawən/	shoe	/ʃu/	/ʃu/
three	/θri/	/tri/	sled	/slɛd/	/sɛ/
black	/blæk/	/blæ/	smooth	/smuʒ/	/mus/
green	/grin/	/gwin/	snake	/sneik/	/neis/
yellow	/jɛlou/	/jɛwo/	soap	/soup/	/so/
doll	/dal/	/dal/	spoon	/spun/	/pun/
feather	/fɛðɚ/	/fevɚ/	spring	/sprIŋ/	/pwiŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/kəwəz/
flower	/flauwɚ/	/fəuwə/	star	/staɚ/	/daɚs/
fork	/fɔɚk/	/foɚs/	string	/strIŋ/	/driŋg/
glasses	/glæsIz/	/glæs/	sweater	/swetɚ/	/wedɚ/
glove	/glʌv/	/gʌs/	tele-vision	/teləvIʒən/	/teuɪzən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/daes/
hanger	/hæŋɚ/	/hæŋgə/	thumb	/θʌm/	/təm/
horse	/hɔɚs/	/hoɚsi/	tooth-brush	/tuθbrʌʃ/	/tubrʌʃ/
ice cubes	/ɔIskjubz/	/ɑɪt kjuz/	truck	/trʌk/	/twa/
jump rope	/dʒʌmproup/	/dʒʌro/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lis/	vase	/veis/	/veis/
mask	/mæsk/	/mæs/	watch	/watʃ/	/was/
mouth	/mauθ/	/maus/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musɪ ba/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/nos/			

ESL Subject 6

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛləplein/	page	/peidʒ/	/peitʃ/
basket	/bæskIt/	/bæskɪt/	quarter	/kwɔɚtɚ/	/kwɔədə/
bed	/bed/	/bɛt/	rouge	/ruʒ/	/ruz/
candle	/kændl̩/	/kændo/	rug	/rʌg/	/rʌk/
chair	/tʃɛɚ/	/tʃeɚ/	Santa Claus	/sæntəklɔz/	/sendəklaz/
cowboy hat	/kauboihæt/	/kaboi hæt/	screw-driver	/skrudraivɚ/	/skədɪbə/
crayons	/kreiənz/	/krɔez/	shoe	/ʃu/	/su/
three	/θri/	/dri/	sled	/slɛd/	/slɛ/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/sneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sop/
doll	/dal/	/da/	spoon	/spun/	/spunk/
feather	/fɛðɚ/	/fedɚ/	spring	/sprIŋ/	/sprã/
fish	/fIʃ/	/fɪs/	squirrel	/skwɝl/	/skwɜ/
flower	/flauwɚ/	/frəuwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɚk/	/fok/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæsəz/	sweater	/swetɚ/	/swɛdə/
glove	/glʌv/	/glʌb/	tele-vision	/tɛləvIʒən/	/tɛləvɪʃ/
gun	/gʌn/	/gã/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/hæŋgɚ/	thumb	/θʌm/	/tʌm/
horse	/hɔɚs/	/hoɚs/	tooth-brush	/tuθbrʌʃ/	/tusbrʌs/
ice cubes	/ɔIskjubz/	/əIskju/	truck	/trʌk/	/tʌk/
jump rope	/dʒʌmproup/	/ʒʌmpro/	tub	/tʌb/	/tʌp/
leaf	/lif/	/lif/	vase	/veis/	/bes/
mask	/mæsk/	/mæs/	watch	/watʃ/	/wats/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mus ba/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/nos/			

ESL Subject 7

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɛpein/	page	/peidʒ/	/pe/
basket	/bæ skIt/	/bæesən/	quarter	/kwɔɚtɚ/	/kwadə/
bed	/bɛd/	/bɛ/	rouge	/ruʒ/	/wuz/
candle	/kæ ndl/	/kændo/	rug	/rʌg/	/wʌ:/
chair	/tʃɛɚ/	/tʃʌ/	Santa Claus	/s æntəklɔz/	/sændəka/
cowboy hat	/kauboihæ t/	/haboihæ/	screw-driver	/skrudraivɚ/	/udwɑɪbə/
crayons	/kreiənz/	/wrensa/	shoe	/ʃu/	/ʃu/
three	/θri/	/ɹwi/	sled	/slɛd/	/ɛɛd/
black	/blæ k/	/blæe/	smooth	/smuð/	/θəmuə/
green	/grin/	/wrin/	snake	/sneik/	/θənek/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/θo/
doll	/dal/	/dal/	spoon	/spun/	/θpun/
feather	/fɛðɚ/	/fɛðə/	spring	/sprIŋ/	/θəpwei/
fish	/fI ʃ/	/fɪ θ/	squirrel	/skwɚl/	/θəwə'ə/
flower	/flauwɚ/	/fəuwə/	star	/staɚ/	/θəda/
fork	/fɔɚk/	/fok/	string	/strIŋ/	/dwi/
glasses	/glæsIz/	/læsə/	sweater	/swɛtɚ/	/fɛdə/
glove	/glʌv/	/lʌf/	tele-vision	/tɛləvIʒən/	/tɛləwɪzə/
gun	/gʌn/	/ʌn/	that	/ðæt/	/fæ:/
hanger	/hæŋɚ/	/heŋə/	thumb	/θʌm/	/tʌ:/
horse	/hɔɚs/	/hos/	tooth-brush	/tuθbrʌʃ/	/tʌbwʌ/
ice cubes	/ɔIskjubz/	/əɪskjʌ/	truck	/trʌk/	/tʌk/
jump rope	/dʒʌmproup/	/dʒʌwo/	tub	/tʌb/	/tʌb/
leaf	/Iif/	/li/	vase	/veis/	/ve:/
mask	/mæ sk/	/mə æ/	watch	/watʃ/	/wʌtʃ/
mouth	/mauθ/	/mauθ/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/musə ba/	zipper	/zIpɚ/	/ʒəɪpə/
nose	/nouz/	/no/			

ESL Subject 8

Word	Target	Response	Word	Target	Response
airplane	/ɛəplein/	/ɛplein/	page	/peidʒ/	/peiʤ/
basket	/bæskIt/	/bæʃei/	quarter	/kwɔətə/	/kordɚ/
bed	/bɛd/	/bɛd/	rouge	/ruʒ/	/wuz/
candle	/kændl̩/	/hændo/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃɛɚ/	Santa Claus	/sæntəklɔz/	/sɛnəaz/
cowboy hat	/kauboihæt/	/haboi hæ/	screw-driver	/skrudraivɚ/	/səudrɑrbə/
crayons	/kreiənz/	/krən/	shoe	/ʃu/	/ʃuz/
three	/θri/	/θəri/	sled	/slɛd/	/sɔlɛ/
black	/blæk/	/blæk/	smooth	/smuð/	/səmuv/
green	/grin/	/wei/	snake	/sneik/	/ʃneik/
yellow	/jɛlou/	/jɛlo/	soap	/soup/	/sotʃ
doll	/dal/	/dal/	spoon	/spun/	/ʃəpun/
feather	/fɛðɚ/	/fɛθɚ/	spring	/sprIŋ/	/səpwIŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/səwɜ/
flower	/flauwɚ/	/fouwɚ/	star	/staɚ/	/stɑɚ/
fork	/fɔɚk/	/foɚk/	string	/strIŋ/	/stwɪŋ/
glasses	/glæsIz/	/wræs/	sweater	/swɛtɚ/	/səwɛdɚ/
glove	/glʌv/	/əlʌv/	tele-vision	/tɛləvIʒən/	/tɛəbIzə/
gun	/gʌn/	/ʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/heinɚ/	thumb	/θʌm/	/tʌm/
horse	/hɔɚs/	/hoʃ/	tooth-brush	/tuθbrʌʃ/	/tubrʌʃ/
ice cubes	/ɔIskjubz/	/ɚtsjub/	truck	/trʌk/	/trak/
jump rope	/dʒʌmproup/	/dʒʌmpwo/	tub	/tʌb/	/tʌb/
leaf	/lif/	/lif/	vase	/veis/	/veʃ/
mask	/mæsk/	/mæs/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojo/
music box	/mjuzIkbaks/	/mu: ba/	zipper	/zIpɚ/	/ʃɪpɚ/
nose	/nouz/	/noʃ/			

ESL Subject 9

Word	Target	Response	Word	Target	Response
airplane	/ɛɚplein/	/ɜplein/	page	/peidʒ/	/peicʒ/
basket	/bæskIt/	/bæskɪt/	quarter	/kwɔɚtɚ/	/kwacɚ/
bed	/bɛd/	/bed/	rouge	/ruʒ/	/ruz/
candle	/kændl̩/	/kaendəl/	rug	/rʌg/	/rʌg/
chair	/tʃɛɚ/	/tʃeɚ/	Santa Claus	/sæntəklɔz/	/senəklaz/
cowboy hat	/kauboihæt/	/kaboihæ/	screw-driver	/skrudraivɚ/	/skudraivɚ/
crayons	/kreiənz/	/krɔen/	shoe	/ʃu/	/ʃuz/
three	/θri/	/ɕri/	sled	/slɛd/	/sled/
black	/blæk/	/blæk/	smooth	/smuð/	/smuv/
green	/grin/	/grin/	snake	/sneik/	/snek/
yellow	/jɛlou/	/jelo/	soap	/soup/	/sop/
doll	/dal/	/dal/	spoon	/spun/	/spuən/
feather	/fɛðɚ/	/fɛðɚ/	spring	/sprɪŋ/	/sprɪŋ/
fish	/fIʃ/	/fɪʃ/	squirrel	/skwɝl/	/skwɜəl/
flower	/flauwɚ/	/flauwɚ/	star	/staɚ/	/staɚ/
fork	/fɔɚk/	/foɚk/	string	/strIŋ/	/strɪŋ/
glasses	/glæsIz/	/glæes/	sweater	/swɛtɚ/	/swɛdɚ/
glove	/glʌv/	/glʌel/	tele-vision	/tɛləvIʒən/	/teəvɪzən/
gun	/gʌn/	/gʌn/	that	/ðæt/	/dæt/
hanger	/hæŋɚ/	/heiŋɚ/	thumb	/θʌm/	/tʌm/
horse	/hɔɚs/	/hɔɚs/	tooth-brush	/tuθbrʌʃ/	/tubrʌʃ/
ice cubes	/ɔIskjubz/	/aɪskjubz/	truck	/trʌk/	/trʌk/
jump rope	/dʒʌmproup/	/dʒʌmrok/	tub	/tʌb/	/tʌb/
leaf	/lif/	/liv/	vase	/veis/	/wez/
mask	/mæsk/	/mæsk/	watch	/watʃ/	/watʃ/
mouth	/mauθ/	/mauf/	yoyo	/joujou/	/jojõ/
music box	/mjuzIkbaks/	/mosɪksbaks/	zipper	/zIpɚ/	/zɪpɚ/
nose	/nouz/	/noz/			

APPENDIX E

Probabilities of phonological processes used in the binomial distribution analysis

Those numbers which are underlined indicate the level of chance was less than .05, the level of confidence in this study. For explanations of abbreviations, please refer to page 11.

EFL 1 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
	SR																	
8.57	CR	1211		0131	0308	0989	9522	0444	0054	0056	2801	0064	1.00	0020	1902	3789	0060	0031
	OSO																	
	STD																	
	VD																	
7.69	PV	1615		0293	0561	1336		0719	0160	0164	2713	0173	9522	0086	2301	4839	0173	0114
	PD																	
	S																	
	AF																	
25.0	DA	0601		0271	0349	0536		0375	0214	0214		0226	3173	0173	0751	1336	0226	0198
	P																	
7.14	DP	2113		0719	1031	1835		1211	0512	0512		0536		0357	2713	5419	0536	0424
	E																	
	M																	
5.04	SD	2713		0188	0643	2187		0969	0040	0044		0051		0005	3898		0051	0012
	AS																	
	ATS																	

EFL 2 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
	SR																	
8.57	CR	1211		0131	0308	5823	9522	0444	0052	0056	7263	0064	2301	0121	1902	1471	0060	0031
	OSO																	
	STD																	
4.67	VD	3524		1141	1770		6527	2077	0784	0801	9601	0836	4839	1443	4354	5485	0836	0629
7.69	PV	1615		0293	0561			0719	0160	0164	7566	0173	2713	0332	2301	2263	0173	0114
	PD																	
	S																	
	AF																	
	DA																	
	P																	
	DP																	
0.52	E	8572		7039	8808			9362	5157	5287	5287	5485	7566		7795	0989	5419	4065
	M																	
2.88	SD	5287		1031	2187			2801	0404	0424	8181	0477	7188		6527		0477	0209
	AS																	
	ATS																	

EFL 3 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
	SR																	
8.57	CR	1211		0131	0308	0989	9522	3030	0375	0404	7263	0064	2301	0121	8966	3789	0444	0477
	OSO																	
	STD																	
	VD																	
7.69	PV	1615		0293	0561	1336		3789	0751	0801	7566	0173	2713	0332	9522	4839	0836	0930
2.70	PD	4965		1770	2670	4533			3953	4065	8808	1211	6672	2187	4965	6892	4237	4777
0.93	S	9362		4654	6455	8808				9761	6171	3421	9203	6312	1676	0672	9601	8026
0.96	AF	9203		4533	6312	8808					6171	3271	9203	6171	1676	0751	9761	8337
	DA																	
	P																	
	DP																	
0.53	E	8572		7039	8808	8966					5287	5485	7566		0989		5961	4237
6.25	M	2380		0801	1188	2133					8026	0601	3421			6171	1770	1936
5.04	SD	2713		0188	0643	2187					1.00	0051	4533	0090			0836	0891
1.0	AS	9124		4473	6171	8572					6312	3173	9362					8572
1.41	ATS	8337		3271	5093	7795					6672	2113	9920					

EFL 4 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
4.76	SR		6818	1031	1527	2713	4533	1835	2187	0719	9124	0751	4354	1936	3953	7039	2301	1615
8.57	CR			0131	0308	0989	6892	0444	0375	0056	7263	0064	2301	0257	1902	2891	0444	0214
	OSO																	
	STD																	
	VD																	
11.54	PV			0069	0164	0536		0026	0198	0031	5823	0034	1389	0139	1141	1527	0226	0114
	PD																	
0.93	S			4654	6455	8808		7039		3271	6171	3421	9203	9761	9601	1188	9601	8181
	AF																	
	DA																	
	P																	
	DP																	
1.06	E			4473	6312	8966		7039		2801	6101	3030	8966		9522	0643	9203	8181
	M																	
4.32	SD			0332	0989	2801		1389		0093	9522	0108	5287		4654		1389	0512
1.0	AS			4473	6171	8572		6892		3030	6312	3173	9362		9920			7642
0.70	ATS			5823	7642	1.00		8337		4179	5619	4354	8337		8729			

EFL 5 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
4.76	SR		9761	1031	1527	2713	7414	1835	2187	0719		0751		1260	3953	8181	2301	1615
5.71	CR			0455	0891	2077	7414	1141	1211	0244		0271		0512	3271	7263	1336	9203
	OSO																	
	STD																	
	VD																	
7.69	PV			0293	0561	1336		0719	0751	0164		0173		0332	2301	4839	0836	0500
	PD																	
0.93	S			4654	6455	8808		7039		3271		3421		6312	9601	0672	9601	8181
	AF																	
75.0	DA	0028	0020	0001	0001	0002	0046	0001	0001	0001		0001	5823	0001	0007	0007	0001	0001
	P																	
57.14	DP	0005	0001	0000	0000	0000	0007	0000	0000	0000		0000		0000	0001	0000	0000	0000
0.53	E			7039	8808	8966		9362		5287		5485			7795		5961	8026
	M																	
5.04	SD			0188	0643	2187		0969		0044		0051		0090	3898		0836	0257
1.00	AS			4473	6171	8572		6892		3030		3173			9920			7642
0.70	ATS			5823	7642	1.00		8337		4179		4354			8729			

EFL 6 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
4.76	SR		9761	1031	1527	2713	7414	1835	0703	0719	9124	0751	4354	1260	3953	7039	0719	0574
5.71	CR			0455	0891	2077	7414	1141	0244	0244	8808	0271	3789	0512	3271	6101	0271	0164
	OSO																	
	STD																	
	VD																	
7.69	PV			0293	0561	1336		0719	0160	0164	7566	0173	2713	0332	2301	3898	0173	0114
	PD																	
	S																	
	AF																	
	DA																	
	P																	
	DP																	
0.53	E			7039	8808	8966		9362	5157	5287	5287	5485	7566		7795		5419	4065
	M																	
4.32	SD			0332	0989	2801		1389	0086	0093	9522	0108	5287	0209	4654		0108	0031
	AS																	
	ATS																	

EFL 7 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
4.76	SR		6818	1031	1527	2713	7414	1835	0703	0719	9124	0751	4354	1936	3953	9203	2301	1615
8.57	CR			0131	0308	0989	9522	0444	0375	0056	7263	0064	2301	0257	1902	4654	0060	0214
	OSO																	
	STD																	
	VD																	
7.69	PV			0293	0561	1336		0719	0160	0164	7566	0173	2713	0601	2301	5755	0173	0500
	PD																	
0.93	S			4654	7642	6312		7263		3271	6171	3421	9203	9761	9601		3371	8181
	AF																	
	DA																	
	P																	
	DP																	
1.06	E			4473	6312	8966		7039		2801	6101	3030	8966		9522		2937	8181
	M																	
5.76	SD			0108	0424	1738		0672	0394	0020	9362	0027	3789	0160	3271		0024	0131
	AS																	
0.70	ATS			5823	7642	1.00		8337		4179	5619	4354	8337		8729		4354	

EFL 8 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
4.76	SR		6818	1031	1527	2713	7414	6312	0703	0719	9124	0751	4354	0455	3953	9203	0719	0574
8.57	CR			0131	0308	0989	9522	3030	0054	0056	7263	0064	2301	0020	1902	4654	0060	0031
	OSO																	
	STD																	
	VD																	
7.69	PV			0293	0561	1336		3789	0160	0164	7566	0173	2713	0086	2301	5755	0173	0114
2.70	PD			1770	2670	4533			1141	1188	8808	1211	6672	0703	6101	5755	1211	0891
	S																	
	AF																	
	DA																	
	P																	
	DP																	
	E																	
	M																	
5.76	SD			0108	0424	1738			0016	0020	9362	0027	3789	0001	3271		0024	0007
	AS																	
	ATS																	

EFL 9 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
9.52	SR		0561	0214	0404	0989	8026	5287	0121	0124	6527	0131	8808	0238	1738	1585	0131	0086
	CR																	
	OSO																	
	STD																	
	VD																	
7.69	PV		0801	0293	0561	1336		6892	0160	0164	7566	0173	9522	0332	2301	2263	0173	0114
5.41	PD		1336	0512	0969	2187			0257	0278	9124	0293	7039	0561	3524	3953	0293	0183
	S																	
	AF																	
	DA																	
	P																	
7.14	DP		1260	0719	1031	1835			0512	0512	7414	0536		0873	2713	3125	0536	0424
0.53	E		9601	7039	8808	8966			5157	5287	5287	5485			7795	0989	5419	1031
	M																	
2.88	SD		3030	1031	2187	4654			0404	0424	8181	0477			6527		0477	0209
	AS																	
	ATS																	

ESL 1 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
14.29	SR		4965	0044	0099	0349	4839	2585	1211	0131	4777	0020	5823	0151	4839	2005	0316	0069
8.57	CR			0131	0308	0989	9522	6171	3524	9601	7263	0064	1000	0477	8966	5755	1031	0214
	OSO																	
	STD																	
	VD																	
7.69	PV			0293	0561	1336		6892	4533	0801	7566	0173	9522	0930	9522	6672	1676	0500
5.41	PD			0512	0969	2187			7414	1389	9124	0293	7039	1676	7795	9601	2891	0873
4.67	S			0308	0873	2501				1096	9920	0108	5157	1310	5961	5755	3125	0477
0.96	AF			4533	6312	8808					6171	3271	1471	7642	1676		5823	7949
	DA																	
	P																	
7.14	DP			0719	1031	1835					7414	0536		1770	9124	6892	2501	1096
1.59	E			2801	4654	7414					6672	1676			2005		7263	5287
6.25	M			0801	1188	0278					8026	0601				7949	2801	1260
6.47	SD			0060	2113	1336				0244	8966	0012		0226			1031	0064
2.00	AS			2187	3628	6171					7414	1310						3898
0.70	ATS			5823	7642	1.00					5619	4354						

ESL 2 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
9.52	SR		6672	2187	4065	4965	8026	2801	7263	0124	3524	0131	6527	0424	1738	4965	1141	1031
14.29	CR			0404	6672	2301	4654	0801	2937	0002	4654	0002	9124	0016	0574	1389	0121	0086
2.94	OSO					6527	3030	9522	1527	0672	0989	0751	1096	2801	6171	3271	6672	6455
18.18	STD			0069		0989	2460	0226	0930	0001	5961	0001	8415	0001	0214	0308	0012	0007
4.17	VD						6527	7188	6101	0801	1770	0836	2891	2263	4354	8572	4354	4237
7.69	PV							3789	9522	0164	2713	0173	4965	0601	2301	6672	1676	1527
2.70	PD								2713	1188	1141	1211	1471	3524	6101	4654	6672	6527
8.41	S									0002	2301	0002	3953	0020	1738	5619	0375	0244
	AF																	
25.0	DA									0214		0226	5485	0424	0751	1738	0672	0672
	P																	
14.29	DP									0074		0078		0238	0930	2501	0601	0536
1.06	E									2801		3030			9522		4839	4473
	M																	
6.47	SD									0007		0012		0074	2713		1031	0719
2.00	AS									1211		1310			7949			1.00
2.11	ATS									0930		1031			7949			

ESL 3 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
9.52	SR		4777	2187	2187	8808	8026	5287	1676	0124	6527	0601	2077	0969	1738	4965	0601	1527
17.14	CR			0164	0214	3681	3030	1211	0074	0001	3898	0012	0455	0016	0316	0601	0012	0051
2.94	OSO				9203	2713	3030	5093	8966	0672	8572	3789	6672	6101	6171	3271	3681	8572
2.27	STD					2670	2937	4839	1.00	1389	8337	5093	7414	7414	6818	3371	4965	9761
8.33	VD						9203	6312	2113	0151	7188	0751	2460	1188	2113	5961	0751	1902
7.69	PV							6892	2380	0164	7566	0836	2713	1336	2301	6672	0836	2187
5.41	PD								4065	0278	9124	1527	4065	2460	3524	9601	1471	3789
2.80	S									0561	8181	3953	7188	6672	6527	1936	3898	9761
	AF																	
	DA																	
1.01	P									3030	6312		9522	5961	9920		1.00	3789
	DP																	
2.12	E									0836	7263		8572		8026		5823	6672
	M																	
6.47	SD									0007	8966	0293	3271	0512	2713		0293	1527
1.00	AS									3030	6312		9362		9920			3789
2.82	ATS									0455	8181		7263		6672			

ESL 4 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
14.29	SR		3371	0751	0099	2585	4839	0143	0278	0293	4777	0020	5823	0151	4839	4179	0143	1211
25.71	CR			0007	0001	0238	0703	0001	0001	0001	2005	0000	1471	0001	0989	0164	0001	0007
2.94	OSO				2301	6527	3030	2801	6171	6455	8572	0751	3681	4354	4354	0891	3681	5823
	STD																	
4.17	VD				1770		6527	2077	4065	4237	9601	0836	6527	3125	7263	5157	2713	8966
7.69	PV				0561			0719	1471	1527	7566	0173	9522	0930	9522	9362	0836	4654
	PD																	
1.87	S				3898			4533		9761	7263	1443	2301	7949	2670		6527	2187
1.92	AF				3789			4473			7414	1389	2380	7642	2713		6312	2301
	DA																	
	P																	
7.14	DP				1031			1211			7414	0536		1770	9124	9920	1527	5287
1.59	E				4654			5419			6672	1676			2005		8026	0873
6.25	M				1188			1389			8026	0601				8808	1770	6101
9.35	SD				0050			0105	0108	0124	7188	0001		0012			0028	1527
1.00	AS				6171			6892			6312	3173						0891
4.93	ATS				0672			1031			1.00	0056						

ESL 5 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
9.52	SR		0000	4237	1031	1031	5823	5287	3271	0124	3524	0601	3371	0424	4237	5419	0601	1031
68.57	CR			0000	0001	0027	0001	0000	0000	0000	0989	0000	0024	0000	0007	0000	0000	0000
17.65	OSO				2301	2301	8572	8966	0060	0000	5619	0001	6527	0000	8181	7188	0001	0001
27.27	STD					8415	2713	2380	0002	0000	9362	0000	7263	0000	5485	0969	0000	0000
29.17	VD						2501	2301	0016	0000	9761	0001	6455	0001	4839	1260	0001	0001
15.38	PV							9601	0751	0007	5287	0060	6101	0028	7414	9362	0056	0124
16.22	PD								0357	0001	5287	0014	6171	0005	7642	8808	0012	0031
4.67	S									0093	1310	1260		0601	0643		1211	2713
	AF																	
25.0	DA									0214		0477	7795	0424	6892	4777	0477	0672
1.01	P									3030				9203			1.00	5823
21.43	DP								0455	0012		0060		0037	8572	5093	0056	0108
1.06	E									2801							9203	4473
18.75	M									0012		0080		0051		6527	0078	0143
15.83	SD								0040	0000		0001		0000			0001	0001
1.00	AS									3030								5823
2.11	ATS									0930								

ESL 6 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
14.29	SR		1260	2187	3271	2585	7642	7039	2187	0020		0020		0151	0751	7414	0574	0278
20.0	CR			0357	0873	0784	4065	9124	0316	0001		0001		0002	0173	2801	0031	0007
5.88	OSO				8026	9124	3371		9124	0074		0080		0836	3173	1211	3681	1676
6.82	STD					7642	4839	1074	8572	0090		0099		0784	2585	2937	2891	1443
4.17	VD						3789	0930	8415	0801		0836		3125	4354	2380	6101	4237
11.54	PV							4654	3524	0031		0034		0244	1141	9601	0969	0455
18.92	PD			0455					0404	0001		0001		0002	0209	3371	0040	0007
6.54	S									0016		0016		0308	2713	0989	2501	0873
	AF																	
100.0	DA	0002	0002	0000	0001	0001	0001	0002	0000	0000		0000	0601	0000	0000	0001	0000	0000
	P																	
57.14	DP	0080	0139	0001	0001	0002	0027	0099	0001	0000		0000		0000	0001	0005	0000	0000
1.59	E									1527		1676			9203		4065	7039
	M																	
12.95	SD									0000		0000		0001	0512		0046	0002
3.00	AS									0477		0536			6171			6455
2.11	ATS									0930		1031			7949			

ESL 7 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
	SR																	
54.29	CR	0000		0037	0455	7414	0131	0000	0000	0000	2937	0000	0357	0000	0000	0002	0000	0000
25.0	OSO	0007			4237		8966	0078	0001	0000	8415	0000	8572	0001	0027	5619	0000	0002
31.81	STD	0001				1471	4533	0016	0000	0000	8966	0000	4965	0000	0007	1676	0000	0001
50.0	VD	0000		0278			0500	0001	0000	0000	3898	0000	0836	0000	0001	0056	0000	0000
23.08	PV	0046						0424	0020	0001	8026	0002	9601	0024	0121	8026	0002	0164
5.41	PD	2585							4065	0278	1835	1527	1096	5157	3524		1471	9761
2.80	S	5287								0561	0836	3953		4237	6527		3898	2113
	AF																	
25.0	DA	0601								0214		0477	7795	0989	0751	7039	0477	1676
1.01	P	9124								3030				2005	9920		1.00	
21.43	DP	0183							0188	0012		0060		0238	0316	8966	0056	0751
3.70	E	4065								0131					5419		2005	2713
	M																	
21.58	SD	0012						0131	0000	0000		0000		0000	0046		0000	0002
1.0	AS	9124								3030					9920			
6.34	ATS	1835								0012		0332			2801		0316	

ESL 8 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
14.29	SR			5485	3271		4839	2585	0801	0020	4777	3371	9601	0801	0751	8808	0143	0151
40.0	CR	0404		0007	0002	2937	0028	0002	0000	0000	0574	0001	0801	0000	0001	0016	0000	0000
10.29	OSO				5755		8026	4473	0930	0002	6527	6101	5619	0801	1141	4354	0060	0054
6.81	STD						8337	8337	3898	0090	8337	8808	3628	4065	2585	1936	0719	0801
54.17	VD	0044		0001	0001		0002	0001	0000	0000	0151	0000	0124	0000	0001	0001	0000	0000
7.69	PV							6892	3421	0164	7566	9124	4965	3524	2301	4237	0836	0930
5.41	PD								5755	0278	9124	6892	2937	6171	3524	1389	1471	1676
3.74	S									0226	9124	1936	1211	8966	5287		2187	2501
	AF																	
	DA																	
8.08	P									0005	7795		3789	1835	1835	1389	0131	0124
14.29	DP									0074	4654			1260	0930	8415	0316	0349
4.23	E									0069	9362				4777		1336	1443
	M																	
14.39	SD								0034	0000	4839			0012	0357		0001	0001
1.0	AS									9920	6312				9920			8572
1.41	ATS									1936	6672				9362			

ESL 9 SCORES		SR	CR	OSO	STD	VD	PV	PD	S	AF	DA	P	DP	E	M	SD	AS	ATS
9.52	SR		8966	3421	2187	0989	8026	2801	1031	0124	6527	0131	6527	0969	1738	5755	6101	0672
11.43	CR			1936	1096	0455	6818	1615	0308	0012	5823	0014	7039	0226	1031	3681	0012	0143
4.41	OSO				6312	2801	4777	7642	3371	0226	9761	0244	1770	3030	4473	4965	0244	2005
2.27	STD					5157	2937	8808	7414	1389	8337	1471	1096	7414	6818	2585	1443	5619
	VD																	
7.69	PV					1336		3789	1471	0164	7566	0173	4965	1336	2301	7795	0173	0930
2.70	PD					4533			6312	1188	8808	1211	1471	6312	6101	3789	1211	4777
1.87	S					6455				1336	7263	1443		9761	8181		1389	7566
	AF																	
	DA																	
	P																	
14.29	DP					0512			0536	0074	4654	0078		0477	0930	2937	0078	0349
2.12	E					6171				0836	7263	0930			8026		0891	6892
	M																	
7.19	SD					1031			0512	0005	8415	0007		0278	2301		0007	0143
	AS																	
1.41	ATS					7795				1936	6672	2113			9362		2077	

APPENDIX F

Phonemes in the Hmong Language

The phonemes which are present in the Hmong language are presented below. A description of the sound is also included. An asterisk denotes those sounds which are also present in the English language.

Consonants

/p'/	This sound is like the English /p/, but is aspirated as a distinctive feature.
/p/*	This sound is like the English /p/, and is not aspirated.
/t'/	This sound is like the English /t/, with aspiration.
/t/*	This sound is like the English /t/, and is not aspirated.
/ṭ'/	This is an aspirated sound which sounds to our ear like "tr."
/ṭ/	This is the sound described above without aspiration.
/tj'/	This is an aspirated sound which sounds to our ear like "ty."
/tj/	This is the same sound as described above, but without aspiration.
/k'/	This is like the English /k/, but is aspirated.

/k/*	This is similar to the English /k/.
/k̇'/	This sound is produced far back in the mouth, and is aspirated.
/k̇/	This is similar to the sound above, but is not aspirated.
/ts'/	This is similar to the English "ts" which occurs at the end of words, e.g., wants, eats, but this sound occurs anywhere in Hmong and is also aspirated.
/ts/	This is the same sound as above, but is not aspirated.
/tʃ'/	This is similar to the "ch" in English, but is aspirated.
/tʃ/*	This is the same sound as above, and is not aspirated.
/f/*	This sound is the same as the English /f/.
/v/*	This sound is the same as the English /v/.
/s/*	This sound is the same as the English /s/.
/sj/	This sound is similar to the combination of "sy" in English.
/ʒ/*	This sound is the same as the English "zh", as in the word "measure."
/ʃ/*	This sound is the same as the English "sh", as in the word "she."

/j/*	This sound is the same as the English "y", as in the word "you."
/h/*	This sound is the same as the English "h", as in the word "hi."
/m/*	This sound is the same as the English phoneme /m/.
/m̥/	This is a single sound which is produce by making an "m" sound, but without voicing.
/n/	This sound is similar to the /n/ in English, but is produced with the tongue touching the back of the upper teeth.
/n̥/	This is a single sound which is similar to the /n/ in English, but is voiceless.
/nj/	This sound is similar to the "ny" combination in Spanish, as in the word "señor."
/n̥j/	This is the same same as above, but is voiceless.
/ŋ/*	This is the only consonant which occurs at the ends of words in Hmong.
/l/*	This sound is similar to the /l/ in English.
/l̥/	This is an "l", but is voiceless.

Vowels

/i/*	This sound is similar to the English /i/.
/ə/*	This is similar to the schwa in English.

/u/*	This is similar to the /u/ in English.
/ei/*	This is similar to the English diphthong /ei/.
/ɔ/*	This is similar to the /ɔ/ in English.
/a/*	This is similar to the /a/ in English.
/ia/*	This sound is similar to the "ia" sound in "Tia Maria."
/u/*	This is similar to the vowel sound in the word "renewable."
/ai/*	This is similar to the diphthong /ai/ in English.
/au/*	This is similar to the diphthong /au/ in English.
/ə i/*	This is similar to the schwa in English.
/oŋ/	This is a nasalized vowel.
/ɛŋ/	This is a nasalized vowel.

Characteristics of Hmong

As a Sino-Tibetan language, Hmong is a tonal language involving seven tones. Aspiration and nasalization are both used as distinctive features. The word structure is almost entirely monosyllabic, although there are a few polysyllabic words which are usually compound words like the English "blackbird" or "matchbook." There are no final consonants except for an occasional "ng" sound.

APPENDIX G

A List of English Phonemes used by the Hmong Subjects

If the phoneme was produced appropriately in all opportunities, no data are shown. If the phoneme was not produced appropriately in all opportunities, the number of times it was produced correctly is shown above the number of opportunties there were for that phoneme. These results were taken from responses given by the subjects during the administration of The Assessment of Phonological Processes (Hodon, 1980).

SUBJECT 1

Target phoneme	Initial	Medial	Final
/p/			
/b/			
/m/			
/w/		0/1	
/j/			
/t/			
/d/			
/n/			
/h/			
/f/			
/v/			3/4
/s/			
/z/			
/ʃ/			
/ʒ/		0/1	0/1
/tʃ/			
/dʒ/			
/k/			0/1
/g/			
/ŋ/			
/θ/	0/2		0/2
/ð/	0/1		0/1
/l/			
/r/			
/ɚ/			6/7

SUBJECT 2

Target phoneme	Initial	Medial	Final
/p/			
/b/			
/m/		0/1	
/j/			
/t/			2/3
/d/			
/n/			
/h/			
/f/	1/4		0/1
/v/	0/1	0/2	0/1
/s/			
/z/			
/ʃ/			
/ʒ/			0/1
/tʃ/			
/dʒ/			0/1
/k/			
/g/			
/ŋ/			1/2
/θ/	1/2		0/2
/ð/	0/1		0/1
/l/			
/r/			
/ɚ/			6/7

SUBJECT 3

Target phoneme	Initial	Medial	Final
/p/			2/3
/b/			
/m/			
/w/			
/j/			
/t/			
/d/			0/2
/n/			
/h/			
/f/			
/v/			
/s/	11/12		2/3
/z/			
/ʃ/		0/1	
/ʒ/			
/tʃ/			
/dʒ/			
/k/			3/6
/g/			
/ŋ/		0/1	
/θ/	0/2		0/2
/ð/	0/1		0/1
/l/		1/2	2/3
/r/			
/ɚ/			6/7

SUBJECT 4

Target phoneme	Initial	Medial	Final
/p/			
/b/			
/m/			
/w/			
/j/			
/t/			
/d/			
/n/			
/h/			
/f/			0/1
/v/			
/s/	8/12		2/3
/z/			
/ʃ/			
/ʒ/		0/1	0/1
/tʃ/			
/dʒ/			
/k/			
/g/			
/ŋ/			
/θ/	1/2		0/2
/ð/	0/1		0/1
/l/			2/3
/r/			
/ɚ/			6/7

SUBJECT 5

Target phoneme	Initial	Medial	Final
/p/			1/2
/b/			
/m/			
/w/			
/j/			
/t/			1/3
/d/			1/2
/n/			
/h/			
/f/	3/4		0/1
/v/		1/2	0/1
/s/	2/12		2/4
/z/			0/4
/ʃ/			0/1
/ʒ/		0/1	
/tʃ/			0/1
/dʒ/			
/k/	1/4		1/6
/g/	2/3		0/1
/ŋ/		0/1	
/θ/	0/2		0/2
/ə/	0/1	0/1	0/1
/l/		0/2	1/3
/r/			
/ɚ/			5/7

SUBJECT 6

Target phoneme	Initial	Medial	Final
/p/			1/2
/b/			0/1
/m/			
/w/			
/j/			
/t/			
/d/			0/2
/n/			4/6
/h/			
/f/			
/v/	0/1	1/2	0/1
/s/			
/z/			2/3
/ʃ/	0/1	0/1	0/2
/ʒ/			0/1
/tʃ/	0/1		0/1
/dʒ/	0/1		0/1
/k/			4/6
/g/			0/1
/ŋ/		0/1	1/2
/θ/	0/2		0/2
/ð/	0/1	0/1	0/1
/l/			0/3
/r/			
/ɚ/			4/7

SUBJECT 7

Target phoneme	Initial	Medial	Final
/p/			0/2
/b/			
/m/			0/1
/w/			
/j/			
/t/			1/3
/d/			1/2
/n/			4/6
/h/			
/f/			0/1
/v/		0/2	0/1
/s/	1/12		2/3
/z/			0/4
/ʃ/		0/1	0/2
/ʒ/			0/1
/tʃ/			0/1
/dʒ/			0/1
/k/	5/7		5/7
/g/	0/4		0/1
/ŋ/		0/2	
/θ/	0/2		
/ə/	0/1		
/l/			2/3
/r/	0/3		
/ɚ/			1/7

SUBJECT 8

Target phoneme	Initial	Medial	Final
/p/			0/2
/b/			
/m/			
/w/			
/j/			
/t/			1/3
/d/			1/2
/n/			4/6
/h/			
/f/			
/v/		0/2	
/s/	8/12	1/2	
/z/	0/1	0/1	1/3
/ʃ/		0/1	0/1
/ʒ/			
/tʃ/			
/dʒ/			
/k/	2/6		4/7
/g/	0/4		
/ŋ/			
/θ/	1/2		0/2
/ə/	0/1	0/1	0/1
/l/		1/2	2/3
/r/			
/ɚ/			6/7

SUBJECT 9

Target phoneme	Initial	Medial	Final
/p/			1/2
/b/			
/m/			
/w/			
/j/			
/t/			2/3
/d/			
/n/			
/h/			
/f/			0/1
/v/	0/1		0/1
/s/			2/3
/z/			2/3
/ʃ/			
/ʒ/		1/2	0/1
/tʃ/			
/dʒ/			
/k/			
/g/			
/ŋ/			
/θ/	1/2		0/2
/ð/			0/1
/l/		1/2	2/3
/r/			
/ə/			

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